April 1958

Agriculture

Volume LXV Number 1

Farming in the laboratory

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NINEPENCE MONTHLY

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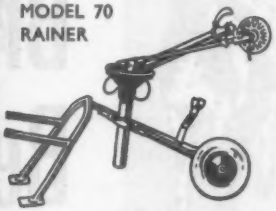

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Cover photograph: Farming in the Laboratory: testing grass-seed for germination *Photo: N.I.A.B.*

Grain drier paid for itself —and brought £100 profit— in one year

A Somerset farmer who grows about 48 tons of barley a year, recently installed an 'in sack' grain drier at a cost of less than £300. At the next harvest he was able to dry his grain and store it. As a result he was paid *nearly £400 more* for his barley than he was offered for it straight off the combine—*enough to pay for the drier and bring in a profit of £100!*

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National Power Farming Conference

S. R. O'HANLON, M.B.E.
Editor, Agriculture

The Seventh National Power Farming Conference, organized by *Practical Power Farming* and the *Farmer and Stock-Breeder*, was held at Cheltenham on February 11–13. Some points by selected speakers.

EFFICIENT farming, efficiently considered, might best sum up this year's National Power Farming Conference, which took as its broad theme the problem of farming costs. There is, of course, nothing new about that theme. Like the poor, it has always been with us. It is the modern aspects of the problem related to the increasing complexities of national and world economic circumstances that demand new thinking if costs are to be equated with remunerative prices. How much labour, what degree of mechanization and the efficiency of coordination—these are the primary considerations which every farmer, large and small, has to face.

Mechanization as an economic proposition

Pointing to the farmers' growing annual expenditure on machinery and its maintenance, MR. J. RHYS THOMAS, a 500-acre Herefordshire farmer, reminded his audience that the total bill for 1954–55 was approximately £200 million. "It is a sobering thought," he said, "to realize that one-seventh of the industry's gross income is spent in buying and maintaining our mechanical equipment . . . and this expenditure has to be supported by the sale of agricultural products." Mr. Rhys Thomas was not suggesting that such spending had got out of hand, but we have reached a stage, he said, when all aspects of our machinery outgoings must be scrutinized with an eagle eye. Of the three groups of business vitally interested in farm mechanization, the farmer, the distributor and agent, and the manufacturer, it is the farmer who has the widest field for making economical use of expenditure on machinery. "But," said Mr. Rhys Thomas, "he is faced with three fundamental aspects of British agriculture: the mixed pattern of production on individual farms, the unpredictable variations in the English climate, and the seasonal use of approximately half the machinery commonly found on farms today. It is, I believe, true to say that tractors, ploughing and cultivating implements and the tractor trailer are, generally speaking, the only items of equipment commonly used in all months of the year.

"The mixed production pattern of the average farm has in the past been a source of strength. In the future we must look for means of simplifying and streamlining channels of production in such a way that the advantages of mixed farming are maintained and investment levels and operating costs on machinery do not get out of hand, and at the same time have regard to the need for farm staff to be productively engaged for as much of the year as is possible and practicable."

Investment in seasonal machinery on the average farm has, Mr. Rhys

Thomas thought, reached a disturbing level. Many of these machines are not operated long enough in a year to make their use a really economic proposition. Why do so many farmers seem to be afraid of joint ownership and use of machinery? It is a fallacy, he said, to regard it as a possible step towards collective farming. Look at the Hampshire Machinery Syndicates operated under predetermined rates of ownership and use. The fact that new groups are being formed and existing ones maintained is proof that the system can and does work.

The other possibility is the contractor. "I am convinced," said Mr. Rhys Thomas, "that farmers with 150 acres or less, with a normal pattern of production, must think very seriously of co-operative ownership and use of machinery or, on the other hand, recognize that the cost of doing a seasonal job will probably be twice as much per hour as his neighbour who does co-operate or farms a larger unit. In the final issue it may mean the difference between profit and loss."

Since 1948 the speaker and a neighbour have shared in the ownership and use of three pick-up balers. The total area involved is over 700 acres. No impossible difficulties have been thrown up over the years, but what has emerged is a definite saving in investment and operating costs.

MR. K. RASMUSSEN (Nottingham University) struck a pessimistic note when he said: "Frankly, I cannot see much scope for (farming) expansion apart from such products as table poultry, and possibly beef and sheep. In particular, I cannot visualize any expansion for milk, pigs or eggs—rather the opposite—and for the arable products there does not seem to me to be much likelihood of any expansion either—rather a slight contraction, apart from barley production." Potatoes and sugar beet, too, he thought, must share this decline. He warned that to be mechanized is not in itself a good thing—only if the mechanization leaves the farmer a higher income than would otherwise have been the case are there grounds for cheering.

It is essential, he said, to assess the conditions for farming under which we shall find out how to make machinery pay. This means that "the farmer should attempt to farm in the way which will give him the highest profit. To attain this, he should not forget the contribution that the wise purchase and use of machinery can make to profit maximization and he should buy all such machines as will add to his profit, and no more."

And that is where the management aspect comes in. The cost incurred for labour, power and machinery on our farms (estimated by MR. IAN G. REID (Wye College) to amount to 50–60 per cent of the total) is a fertile field for work study, the techniques of which should be understood and used by the farmer. "Some of the techniques, particularly of method study, are relatively simple to execute and to understand," said Mr. Reid. "They require no more elaborate equipment than pencil and paper. And yet one wonders whether already a professional esoteric mist has not been created, which deters the farmer himself from learning to use these techniques and the principles upon which the interpretation of their results is based. In its less grandiose forms, work study is called work simplification, and it would be well to take heart from this secondary title."

Work study can often show improvement in the combination of man and equipment. The equipment may be buildings or machinery whose design can

make a considerable contribution to easy and effective operation. Mr. Reid stressed the importance of design, which, he thought, is not fully appreciated by some manufacturers of equipment.

Factory or farm mixing?

MR. V. S. MAXWELL, Managing Director of Silcocks, and MR. JOHN HUNTER, who is farming 500 acres at Hitchin, Herts, looked at the pros and cons of compounding animal feedingstuffs. Mr. Maxwell stressed the value of a specialist service to supply a balanced ration more cheaply and efficiently than a farmer himself could be expected to mix, but Mr. Hunter would have none of it—at least as far as the small user (under a ton a week) is concerned. He likes to vary the diet of his stock and didn't agree that the big plants can mix so much better than he can; after all, he said, it is one of the simpler jobs on the farm.

The home mixing of fertilizers, however, is quite another matter. "I am absolutely against it," Mr. Hunter said, "mainly because of the one word 'granular'. Under modern conditions, one must have granular manure today, and there is no machine to do this on a farm skilfully, and if there were the maintenance and upkeep would be appalling."

For those who are attracted to mixing rations on the farm, MR. CULPIN (N.A.A.S. Silsoe) drew attention to four points: (1) How important is accurate mixing? (2) How does hand mixing compare with machine mixing? (3) How do horizontal mixers and various types of vertical mixers compare with one another? and (4) at what point is it economic to install a mechanical mixer?

"To the first of these questions," said Mr. Culpin, "there is no definite answer. With most commercial stock, minor variations in the ration fed to a given animal on any particular day are unimportant, since they will be more or less balanced out in the long run. On the other hand, feeding a large excess of protein to a few animals is likely to be wasteful, and there are obviously limits to the degree of variability that can be tolerated. It is when one attempts to introduce such things as antibiotics that it is particularly necessary to secure a reasonable even mix.

"On the next two questions, it appears from N.I.A.E. experience that most of the mechanical mixers on the market will do almost as good a job as three times hand mixing with a shovel on a barn floor. The time taken by different mixers varies. Horizontal mixers tend to be a little faster than vertical, but they usually cost more and need more power for a given capacity. New types of horizontal and semi-horizontal mixers recently introduced, however, tend to make even this generalization invalid or of little value. Even with vertical mixers, if the constituents are partly pre-mixed, about 3 minutes' running after filling usually gives a reasonably good result, and 10–15 minutes gives good mixing."

Mr. Culpin went on to say, "It is difficult to justify the cost of mechanical mixing, as compared with shovel mixing, on the grounds of simple costings, with outputs of less than about 50 tons a year—but often mechanical mixing makes the whole business of home-prepared rations a reasonable proposition on an efficiently run holding, whereas it would not be so if hand mixing had to be employed. If the whole operation of home milling and mixing is con-

sidered, a complete small installation incorporating a mixer can often be justified for quantities lower than 50 tons a year."

He did not consider that there is much to be said for farmers spending their time mixing their own fertilizers. "Broadly speaking, with the obvious advantages of using granular fertilizer, there is," said Mr. Culpin, "something wrong with the prices if it pays farmers to forgo the benefits of a good granular compound and make up their own mixtures . . . For farmers who wish to do their own mixing, however, there are machines which are specially designed for pulverizing and mixing fertilizers, and they are made in sizes suitable for large farms." But don't be tempted, he warned his audience, to use food-mixing machines for mixing fertilizers.

No bills for feedingstuffs

The Conference gave a special welcome to MR. T. E. GRIFFITHS, who won the £50 prize in a competition recently staged by the organizers on the subject of making silage pay. He farms 150 acres at 800–1,000 feet near Swansea and relies *entirely* on grass silage for his 78 head of cattle; he buys no feedingstuffs whatsoever. Mr. Griffiths took over his farm in a derelict condition in 1951. By complete reseeding and general improvement, he is getting a herd average of 800–900 gallons per lactation (a milk cheque of £300 per month) and besides that turns out some 45 Friesian × Hereford stores a year. Last year's silage store totalled 450 tons, and it is all self-fed.

Cambridge University Estate Management Club and Department of Estate Management

Summer Lectures

A three-day course of lectures will be held in Cambridge on 26–28 June, 1958. It will include lectures given by:

Professor Sir Solly Zuckerman, Chairman of the Natural Resources (Technical) Committee;

Mr. J. Enoch Powell, M.P.

The Rt. Hon. Lord Justice Parker, Member of the Franks Committee;

Dr. D. R. Denman, University Lecturer in Estate Management, and

Mr. P. A. Stone of the Building Research Station.

There will also be a lecture on the development of land overseas.

Accommodation will be available in College. Those interested in attending this course who would like to receive further particulars and application forms should write to J. Burgon, 74 Trumpington Street, Cambridge.

Weeds: The Ancient Enemy

SIR E. JOHN RUSSELL, O.B.E., F.R.S., D.SC.

Nature favours the weed, but the revolutionary advances in organic chemistry in the last forty years are redressing the balance.

IT is not likely that it will ever be possible to grow crops completely free from weeds. They have so much in their favour. Being mostly native plants and surviving by natural selection, they are vastly more prolific in seed production than most of our crops. A barley plant may produce 40–50 seeds, but a poppy, as Sir Edward Salisbury has shown, produces an average of 17,000, fortunately not all viable in any one year.* The older way of dealing with weeds was by cultivation, fallowing and hand-pulling. Then came the discovery, the result of two chance episodes that could never have been expected outside a cinema, that a weak solution of copper sulphate would kill charlock without much injury to the barley. This brought the problem of weed control within the purview of the chemists, and before long sulphuric acid and finally cyanamide were being used on weedy cereal crops and sodium chlorate and arsenicals for more drastic purposes. Various difficulties prevented wide adoption of chemical treatment, and for fifty years or more it was quite common to see fields of corn in June a blaze of scarlet and yellow.

The swing to organics

The years between the two world wars saw the beginning of a tremendous revolution in the British chemical industry, particularly in the development of technological organic chemistry, whereby almost any of the prodigious multitude of substances that a chemist can prepare on a small scale in the laboratory can, if desired, be made by the ton in the factory. Some of the large chemical organizations set up their own experimental stations to test the agricultural possibilities of these new products.

Organic substances have the great advantage over the simple inorganic substances in that they can be built up in families of similar pattern. Each member is quite distinct and differs from the others only in the number and arrangement of the atoms, or groups of atoms, of which it is composed. Some graduation of many of their properties can be made by systematically adding to or removing particular groups of atoms.

Some of these new products are plant poisons, but very different from the sulphate of copper to which farmers had long been accustomed. Sulphate of copper had to be used at the rate of about 15 lb per acre, and it required 50 gallons of water; only 6–10 lb were needed of DNC, one of the first of the organic poisons on the market, while its close relative, dinoseb, which came later, was so much more effective that only 1 lb per acre was needed. Of course, much greater care is needed with these potent materials; at 3 lb per acre, dinoseb may kill undersown clover.

Properly used, DNC is effective against many of the weeds of cereal crops,

* Sir Edward found one monster producing 480,000 seeds!

but it has definite limitations: it does not kill wild oats, black bent or other weed grasses; it cannot be used for leguminous crops, nor for cereal crops undersown with clovers. On the other hand, dinoseb applied as directed can safely be used on undersown cereals, winter beans, lucerne, peas, sainfoin and also, but only during the dormant season, on strawberries. These differences cannot yet be explained.

The newer poisons are far more effective for the selective control of weeds in crops than the old mineral ones: indeed sodium chlorate and arsenicals cannot be used at all for this purpose, but they are invaluable for keeping gravel paths clean because they persist so long. But the organic poisons do not. Having done their work they fade away, being decomposed by some of the soil organisms—which apparently manage to feed upon them, though how or why they acquired this character is a mystery.

When all is said and done, however, these substances are poisonous and can do harm, so proper care must be taken. Regulations for their use are laid down by the Ministry of Agriculture in accordance with the Agriculture (Poisonous Substances) Act of 1952, and farmers may find it more convenient to have them applied by contractors.

Hormone herbicides and selectiveness

But these are now being displaced by another group of complex organic substances which have the advantage of being non-poisonous yet at least as effective. Its members are modelled on the growth-promoting substances found in plants, and they are sometimes referred to as "hormones", a name derived from a Greek word meaning "to urge on" because they stimulate some vital action in the plant or animal. The natural substance, which is a true plant hormone, is not a herbicide, but many of the modifications made by chemists are, and additions are constantly being made. These new herbicides overact their role as stimulants and upset some of the vital processes in the plant to such an extent that it dies; not instantly, as when killed by a strong poison, but after an interval. Their most remarkable properties are their high degree of selectiveness, their potency against the plants they kill, and their non-poisonous nature. The provisions of the Act mentioned above do not apply to them.

The two best known chemicals in this class are MCPA and 2,4-D. The former is the more popular in this country, the latter in the United States. There are some differences in their behaviour: Dr. Woodford has pointed out that 2,4-D has advantages over MCPA in destroying more weeds, but MCPA is safer—particularly in spring oats. Their remarkable control of some of the common weeds of cereal crops, when applied at rates of about 1 lb per acre, rapidly brought them into favour, and millions of acres are treated each year. In Britain great areas of cereals, grass and other crops are sprayed, as are vast areas in the United States, and most of Canada's cereals and small seeds. Increasingly larger areas are being treated in Australia, South Africa and East Africa. A conference which I attended on herbicides held at the East African Agriculture and Forestry Research Organization in Kenya in January 1957 revealed a large amount of promising experimental data obtained there. These herbicides were discovered in Britain and are manufactured here, forming a valuable export commodity.

Limitation

They do not, however, completely solve the weed problem; in fact they have the defects of their virtues. Being hormones, they affect the vital processes in *all* plants, whether crops or weeds. Their selectiveness simply means that they affect some plants far more than others, or can get into them more easily. Resistant crops escape harm if certain conditions about quantities per acre and stage of growth are satisfied. Wheat and barley are safe with MCPA or 2,4-D used at the rate recommended and when the plants are at their six-leaf stage. But if the herbicides are applied earlier, or in larger quantities, there is a lively risk of deformed plants and loss of crop. Nor do they distinguish between crops and weeds. They destroy a number of broad-leaved weeds, but they equally destroy broad-leaved crops such as clover, peas, and lucerne.

Another limitation is that their selectiveness restricts their range of action; weeds that they do not kill can flourish better after some of their competitors are destroyed. Cleavers used to be associated mainly with winter wheat; now however on farms where MCPA, which does not affect them, is regularly used they have increased considerably in spring-sown corn. Some other important weeds escape MCPA and 2,4-D, including the grasses and wild oats, the mayweeds and corn marigold. Considerable search is being made for herbicides that can deal with them.

Two near neighbours of MCPA, made by replacing the acetic acid group in the molecule by propionic and butyric acid groups respectively, are proving very useful. The propionic compound CMPP is much more toxic to cleavers than MCPA, and less likely to damage the cereal crops, so that it can be applied earlier with better chance of killing the weeds. Like MCPA, however, it damages clovers, and so cannot be used on undersown cereals. CP-1815, a mixture of MCPA and 2,3,6-TBA, also kills cleavers, but cannot be used on cereals so early. The butyric compound MCPB, first systematically studied by Professor Wain and his colleagues at Wye College, is free from this limitation; it can be used not only where clovers are present but on other leguminous crops, including peas—one of the worst of all farm crops for harbouring weeds. Another of the butyric compounds, 2,4-DB, is used widely for controlling weeds in lucerne. Both MCPB and 2,4-DB have a larger margin of safety for use with cereals than MCPA and 2,4-D, and they are less likely to cause deformity.*

Other chemicals

In addition to the two great groups of poisons and hormones, there are a number of other substances of herbicidal value. They are of various chemical families, and their numbers are steadily increasing. Some are promising destroyers of grass and wild oats. Among these are certain complex nitrogen compounds such as CDAA, which can be used in warm countries to kill grass in maize, ground-nuts and soya beans; and a substituted urea that kills grass in sugar beet, cotton and onions. At least one of these compounds does

* For a fuller account of this important group of herbicides see Professor Wain's article in this *Journal*, 1957, **63**, 575–9.

not destroy grass but simply stops its growth so that it remains perpetually short. This seemed a promising agent for keeping putting greens in order, but experiments at the St. Ives Station, Bingley, showed that it was unsuitable for this purpose, though it might be useful on road verges. Some can act in the soil, killing the weed seeds or seedlings before they emerge. TCA applied two weeks before sowing destroyed couch grass in the Rothamsted mangold field, and wild oats in sugar beet, peas and kale at Chesterford Park. Its relative, dalapon, also kills grasses but is applied to the foliage and not to the soil.

But the universal herbicide that will kill all weeds and spare all crops is not yet in sight, nor is it ever likely to be. More probably mixtures of herbicides with their appropriate auxiliaries will be devised to deal with particular aggregates of weeds, not attempting complete elimination which would be too costly, but sufficient reduction below the harmful level.

Intensified research

Chemical weed control is advancing very rapidly, and more than 10,000 papers have been published on the subject in the last five years. Progress will become much faster when the mode of action of the various groups of herbicide is better known. This particular aspect is being investigated at the Oxford University Department of Agriculture by a team under Professor Blackman, and at Wye College by another team under Professor Wain, while Dr. Woodford and John Fryer and other colleagues at Oxford are studying many of the practical problems involved. Search for new products and improved methods of applications is continuously made at the I.C.I. Research Station at Jealott's Hill, where much of the subject originated, at the Plant Protection Research Station at Fernhurst, the Research Stations of Fisons at Chesterford Park, of Shell at Sittingbourne, and of other important industrial organizations.

Chemical aids for controlling weeds and other pests, and various phases of plant growth, will almost certainly require even higher standards of cultivation and general farm management. More knowledge of the chemical and biological properties of the various agents will be needed than the farmer can find time to acquire, and a considerable development of expert plant protection by specialist services seems likely. This will of course necessitate close observation and shrewd judgment by the farmer, for he will need to know with certainty when he is well served. Of the many problems that still remain, the most important is to discover what is the effect on the consumer of this chain of treatments by potent chemicals on crops at the various stages of their progression from the seed to the table. So far there is no evidence of any harm, but constant and entirely impartial watch by the health authorities will be necessary. An Advisory Committee has already been set up with this purpose.

CORRECTION

Choosing the Best Herbicides for Cereals (March issue, pp. 585–92, with special reference to the chart on p. 591). 2,4-D should not be used on spring oats.

Sheep on the Welsh Hills

DAVID LEWIS, M.B.E., J.P.

Deputy Chairman, Brecon Agricultural Executive Committee

Pam, Arglwydd y gwnaethost Gwm Pennant mor dlws,
A bywyd hen fugail mor fyr?

Eifion Wyn

IN all the various fields of farming endeavour, it is the efforts of the hill sheep farmer that have attracted the widest admiration. It is a perennial struggle for the sheep to get a living, and the farmer to earn a livelihood, from the impoverished pastures of our hills. In Wales, hills and mountains are taken for granted, and no one is ever out of sight of them. From Penmaenmawr in Caernarvon to Mynydd Islwyn in Monmouth, and from Hiraethog in Denbighshire to Prescelli in Pembroke, they dominate the entire Principality, and in the county of Brecon over one half of the total acreage lies above 1,000 feet. The importance of the hill flocks in the farm economy of Wales can thus be appreciated.

The character and grazing value of the Welsh hills vary considerably; the thin soils correspond to the underlying rock formation. In the south, millstone grit overlies the South Wales coalfield, further north a little limestone outcrop, then a considerable area of Red Sandstone; the Silurian formation is found in mid-Wales, and the granite-like Cambrian rocks occur in Merioneth and Caernarvon in the north.

Many breeds and types

The herbage, similarly, differs enormously in composition and amount from the lower slopes to the higher altitudes and from south to north Wales. Undoubtedly, it is these varying conditions that explain the multiplicity of breeds and types of hill sheep to be found in Wales. Almost every county has a distinct breed, or at least type, of its own. Perhaps this is a reflection of what is regarded as the Celtic genius.

The majestic, lengthy, hairy-coated, tan-faced Glamorgan Welsh sheep that roam its hills and mining valleys unhindered are very different from the compact, hard-coated, short-legged ewes that clamber up the steeper slopes of the Merioneth and Caernarvon mountains. In Denbigh and North Montgomery there is a very hardy, strong-coated Welsh ewe: on the Brecon Beacons a well-woolled Cheviot-Welsh type has been firmly established. On the Eppynt and Black Mountains the dark-faced Radnor breed is increasing in numbers; further north, in the Rhayader district, the pretty speckled-faced Welsh sheep holds sway, and along the English border in the counties of Brecon, Radnor and Montgomery, the Clun and the Kerry are still hill sheep. The true Cardi ewe of the Cardiganshire uplands is not now the distinct type it once was. In addition, there are the improved Welsh Mountain and the Black Welsh Mountain sheep, greatly admired at the agricultural shows.

Much ill-informed criticism has been levelled at the large number of breeds of sheep kept in a small country like Wales, but it is well to remember

that uniformity ultimately leads to mediocrity, and standardization in sheep breeding implies a temporary halt in adaptation and progress.

Flock policy

Only a few expert breeders of pedigree sheep fully appreciate the high value of pure-blooded strains within a breed. Among some Welsh hill farmers, there is an ingrained tradition against the introduction of outside blood into an established hill flock. In mid-Wales there are many hill flocks where, within living memory, not even a single ram has been introduced into the flock from outside. The reason is a deep-seated fear of impairing the constitution, weakening the hardiness to withstand a difficult climate and lowering the resistance to disease.

To improve a flock while following this breeding policy is most difficult, except where flock numbers are large and ruthless internal selection is practised. It involves the culling of every weakling and unthrifty lamb. It means the autumn drafting of store ewes, not at a specific age, but retaining the good mother for an extra year and selling the poor mother before she reaches the regular drafting age. But the majority of flocks on the Welsh hills are small, and it is well known that the besetting sin of the Welsh hill farmer, especially if he has grazing rights on a common hill, is his ambitious inclination to increase his flock numbers from year to year. Consequently, he keeps every ewe lamb—good, bad and indifferent—and eventually he finds that he has a larger number of ewes than he can provide for when a severe winter comes along.

Breeding methods and practices such as these, which some may regard as outdated, have not lowered the general standard of the flocks. On the contrary, the reputation of the Welsh hill ewes is higher than ever because of their well-recognized traits of unusual thriftiness and of being exceptionally good mothers, calling for a minimum of care and attention even at lambing time. In addition, the very large proportion of pure-blooded strains among the store ewes drafted from the Welsh hills makes them exceptionally valuable as foundation stock. It has for long been the practice to cross the Welsh draft ewe with a pure-bred ram of a lowland breed, exploiting to the full the advantages of hybrid vigour for fat lamb production. Of recent years Welsh draft ewes have been used extensively for crossing with rams of a heavy and more prolific lowland breed such as the Border and Hexham Leicesters. The progeny of this well-designed mating, the Welsh Halfbred ewe, inherits size and high fertility from its sire and thriftiness and good mothering qualities from its dam, a very desirable combination. The maintenance of a sound hill sheep breeding policy is vital to Wales's farming economy, since the contribution of the hills to the farming income is very considerable.

The 1947 tragedy and recovery

Considerable aid was granted to hill farmers during the difficult war years, and the assistance given under the Hill Farming Act, 1946, saved the situation after the disastrous winter of 1946–47 when many hill flocks were decimated. They helped considerably to safeguard the purity of breed of the

hill flocks by insisting on the maintenance of flocks in regular ages. Generous help to meet the serious losses sustained on the hills came from the Disaster Fund and the Lord Mayor's Fund. Many small hill farmers were broken-hearted in April 1947, but the record of the recovery in Wales in sheep numbers since 1947 is amazing. In 1939 the total Welsh sheep population was 4½ million; by 1946 it had dropped to just over 4 million, but in June 1947 the total was only 2,815,000, a drop in one year of 1,234,000. This shows how serious were the 1947 losses; and losses among hill flocks were more than double those in lowland flocks.

The recovery in the following seven years was spectacular. The 1954 total reached 4,497,000, an average increase of just under a quarter of a million (9 per cent) a year. Since 1954 the total number of sheep in Wales has continued at just under 4½ million.

The combined total for the three hill counties of Brecon, Montgomery and Merioneth in 1939 was 1,594,000; by 1956 it had reached 1,755,000—an increase of slightly over 10 per cent. In the county of Merioneth alone there was an increase of 15 per cent. In the lowland counties of Anglesey, Flint and Pembroke, a total of 501,000 in 1939 had gone down to 372,000 in 1956, a drop of over 25 per cent, while in the county of Flint itself there was a reduction of over 40 per cent.

The increase in sheep numbers in Wales must be credited entirely to the hill flocks, and has been a magnificent achievement during the post-war period. It was accomplished despite the fact that since 1938 about 150,000 acres of hill land have been afforested. The density of the sheep population on the Welsh hills at present is extremely high, in fact higher than ever before.

The published statistics do not give the exact figure of the number of sheep on the rough hill and common grazings of Wales, the total acreage of which is 1¾ million—1,334,400 acres of rough grazings and an estimated 450,000 acres of common rough grazings.

The average total number of ewes on which subsidy was paid at the standard and reduced rate during the years 1943–52 and in 1954–55 was approximately 1¼ million—1 ewe to every 1·4 acres. On the fair assumption that the total number of all sheep grazing on the hills in summer is double the number of the ewes, this means 1·5 sheep to the acre during the summer season.

Ponies have almost disappeared from the hill grazings. Less than thirty years ago, a stud of over three hundred Welsh Mountain ponies, kept by one farmer, grazed on the Brecon Beacons during the summer. Many mountain ranges would have to be scoured to find that number today. Also, every year finds fewer and fewer cattle on the hills, and the withdrawal last year of the Hill Cattle Subsidy will lead to a further decline in numbers.

Will the present-day intensive grazing with sheep only maintain the natural sweetness of the herbage on the Welsh hills? Trouble will probably ensue on many hills in mid-Wales where molinia predominates on vast stretches. This very undesirable grass, which is palatable and nutritious for just two months—June and July—and for the rest of the year remains dormant and recumbent, smothers every other grass so that not even a thin-stemmed fescue can push through. Controlled burning may be the answer, but that is difficult and dangerous.

Two scientific discoveries have been of inestimable value to the Welsh hill farmer—carbon tetrachloride and benzene hexachloride. The one controls liver fluke which previously caused such heavy losses among sheep after the wet autumns only too common in Wales, and the other prevents strike by maggot fly. They have eased summer shepherding enormously, especially on hills where bracken has been encroaching.

A better wool crop

It can safely be forecast that the further outlook for sheep on the Welsh hills is promising, and the Zuckerman report* has restored confidence in many areas; but the Welsh hill farmers must pay much more attention to the weight and quality of the fleece. In Merioneth, the average fleece of the hill ewe weighs about 1½ lb; on the hills of Glamorgan the average weight of the fleece is even less. It is interesting to note that the fleece weight for both the Scotch hill sheep breeds, the Cheviot and the Blackface, is about 4 lb, but the comparison may be unfair. The widely-held opinion that kemp connotes hardiness has no critically-examined evidence to support it. The average fleece weight of the ewes on the Brecon Beacons is about 3 lb, and weather conditions there are, if anything, more severe than on the Glamorgan hills.

Fleece improvement should be obtained by careful, studied selection inside the flock, and not through a "short cut" by introducing a ram from another breed. The wool clip provides a very considerable portion of the hill farmer's income, and attention to fleece improvement will pay ample dividends. An increase of ½ lb in the average weight of the fleece of the Welsh ewe would mean an additional income from the Welsh hills of £250,000.

The majority of Welsh hill farms are comparatively small and the flock owner is almost invariably his own shepherd. Tending the flocks on the hills of Wales is a hard, tough life, especially at lambing time if the weather then happens to be unkind, but he is always proud of his flock and knows and loves every nook and cranny of his sheep walk. He has collected a wealth of local weather lore passed on from father to son, and is always accompanied by a firm and faithful friend—his well-trained sheep dog.

Why, Lord, didst thou make Cwm Pennant so grand
And the life of th' old shepherd so short?

Eifion Wyn.

* Office of the Lord President of the Council. Forestry, Agriculture and Marginal Land. Report by the Natural Resources (Technical) Committee. H.M.S.O., 1957. 4*s.* (4*s.* 3*d.* by post).

Seed Control: Present and Future

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In the last resort seed quality is more a matter of service than of regulation, but in the opinion of the Committee on Transactions in Seeds certain amendments and extensions of the Seeds Act, 1920 could help the agricultural industry and the seed trade to achieve still greater efficiency.

PEOPLE who buy seeds should be told what they are buying, and should be able to rely on what they are told. This is the basic principle of the Seeds Act, 1920, and the Committee on Transactions in Seeds, which reported last year,* would like to see it extended to a wider concept of seed quality, including the varietal characteristics and the pests and diseases carried by seeds, in addition to purity and germination.

So far as the Seeds Act is concerned, seed of practically any description, origin or quality may be sold, provided certain facts are disclosed to the buyer so that he can compare the lots he is offered. The only ban is on the sale or sowing of seed containing excessive amounts of certain injurious weeds.

The main agricultural seeds are already covered by the Act, but there are some notable omissions among herbage and vegetable seeds. The Committee proposes that all important agricultural, horticultural and forest tree seeds should now be included, as well as their hybrids and derivatives, and that grass seed for amenity purposes, and flower seeds in packets, should both be subject to a modified form of control.

Particulars to be declared on sale

In general, the statutory description of the seed indicates to the purchaser the kind of crop it will produce, although the distinctive variety is also declared in the case of cereals and certain legumes, and the country of origin in the case of grass and clover seeds. The Committee considered it essential that the name of the variety should now be declared for all seeds where distinct varieties are available, and the salient characters of the type should be described where they are not. This is because of the widespread development of special-purpose varieties. As certification by an independent authority provides the best safeguard that the seed is true to name, it is recommended that the terms "certified" and "field approved" should be restricted to seed which meets the requirements of schemes approved by the Ministry of Agriculture when it is home grown, or by the Government of the country concerned, when it is imported.

Particulars of the results of purity and germination tests must also be declared. Here the Committee thought that more information should be given about the weed seed content, and suggested that the total percentage by weight of weed seeds should be declared for herbage, cereal and certain

* Report of the Committee on Transactions in Seeds. Nov 1957. H.M.S.O. 5*s*. (by post 5*s*. 5*d*.).

field seeds, as well as the actual number of seeds of certain particularly noxious weeds in a given quantity of seed. In this connection, wild oat, dodder, docks and sorrels, black grass and couch grass would replace the injurious weeds prescribed in the present regulations.

Effective methods have now been developed for controlling certain seed-borne diseases, and treated seed is offered for sale where a seed dressing can be applied as a routine measure, as is the case with cereals. The Committee considered that the buyer should be entitled to know the kind of treatment, and whether the percentage germination declared was obtained in a test before or after treatment, because in certain circumstances this may have reduced the germination.

To limit the work involved at rush periods, the exact percentages of purity and germination do not have to be declared for cereals or vegetables, if a general declaration is made by reference to certain minimum percentages specified in the regulations. These have remained unchanged since 1922 and the Committee has brought them into line with modern standards.

Official testing

It is essential that the results of official tests should be reproducible, within specified limits of variation which allow for the normal differences between samples. Except for garden seeds, such tests may only be made at an official seed testing station or at a firm's private station licensed by the Ministry of Agriculture. In practice, one of the conditions of licensing is that the analyst has passed a special course in seed testing at an official station, and can therefore apply the same methods and interpretations. As tests on vegetable seeds require a similar degree of technical control, the Committee recommended that the provision for testing garden seeds in "any other sufficient manner" should now be dropped. The regulations relating to the taking of samples for official tests should also be brought into line with the rules of the International Seed Testing Association, which incorporate recent technical advances and are applied to seed passing in international trade. The period of validity of an official test should be reduced from the present maximum of fourteen months to ten to lessen the risk of changes in the bulk between the time of testing and the delivery of the seed to the purchaser.

To check declarations of variety, it would be necessary to increase the number of growing-on tests, which are made on control samples taken by Ministry inspectors. These samples are at present used primarily to check the accuracy of the declared purity and germination figures, and any legal proceedings have to be instituted within six months; to allow action to be taken after a growing-on test, the Committee suggested the period should be extended to two years.

The Seeds Act makes it unlawful either to sell, or knowingly to sow, seed which contains more than five per cent by weight of the present injurious weeds (docks, geraniums, wild carrot, soft brome, and Yorkshire fog); but this quantity is so great that in recent years no sample has exceeded it. The Committee now proposes that the prohibition should apply to the sale or sowing of seed with a total weed content greater than three per cent by weight. Although this quantity is seldom found in samples submitted by

merchants, it does occasionally occur in samples sent by farmers from seed of their own saving; so it will be necessary to ensure that such seed is cleaned before sowing. The Committee did not think it desirable to extend the present powers for taking samples to include farmers' premises, but recommended that informal investigation samples should continue to be taken by Ministry inspectors with the farmer's permission.

Commercial transactions

In the event of civil proceedings, a seller of seeds is at present safeguarded by a provision of the Act which allows the particulars he declares to be challenged by the purchaser only when a further test has been made within ten days of delivery. This reduces the possibility of deterioration on the purchaser's premises, but does not allow much time to get a check test made. The Committee therefore recommended that the period should be extended to twenty-one days and that the purchaser should notify the seller within three days if he becomes aware of any defects.

The Committee also thought that it would be reasonable for the statutory declaration of purity and germination to have effect as a warranty; and for the seller to accept the same responsibility for the declaration of variety on seed produced under certification and field approval schemes.

Research and advice on variety and health

The Committee has recognized that certain aspects of the problem of improving the quality of seeds call for research and advice, rather than for statutory action, and it has paid particular attention to the need for information on which to base the choice of variety and the assessment of seed health.

The effect of the soil and the climate, as well as the particular use to be made of the crop, all have to be considered before it can be decided which variety to grow. Local custom may provide some guidance, but new varieties with particular advantages have now been developed for most crops. In some cases objective assessments have been made in field trials, and there are recommended lists of varieties, but the Committee were of the opinion that this work should be extended by specialist crop testing organizations. It also recommended that all new varieties of cereals should be submitted for independent trials two years before they are offered for sale.

General requirements for seed health cannot be specified with the same precision as for other aspects of seed quality, because most diseases and pests are restricted to a particular kind of seed. The effect on the subsequent crop is determined to such a large extent by climate and other factors that it may be virtually impossible to predict from a seed sample. The Committee held the view that the primary task is to promote a greater appreciation of the existence and effects of seedborne organisms. It recommended that further surveys should be made to determine the incidence of seedborne pests and diseases, and the production of healthy seed from disease-free crops should be increased by appropriate certification schemes. Details of effective treatments should also be given the widest publicity.

Past experience has indicated three requirements that future seed control measures should fulfil if they are to be accepted by seedsmen and farmers as

necessary to the improvement of seed quality. First, the need for them must be generally recognized; then there must be the necessary technical basis for objective tests on living material, which has a considerable degree of inherent variation; and finally the measures must promote and not hinder the normal commercial procedures, whereby seed is made available at the correct time for sowing and at a price that the buyer can afford. Careful study of the Committee's proposals reveals that these requirements have been kept very much in mind.

Kale in Dorset

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Dairy farmers in Dorset have found that kale as a winter feed can make a real contribution to their income.

ONE of the most striking features of farming in Dorset is the great increase in the kale acreage which has occurred during recent years. In 1952, 10,500 acres were grown, and we estimate that in 1957 the acreage topped the 20,000-acre mark. This represents 10 per cent of the total arable acreage and 20 per cent of the tillage crops. Indeed, kale today occupies a greater acreage than any other crop in the county except grass and barley. This is perhaps not surprising since Dorset is essentially a dairying county, and grazed kale makes a very considerable contribution to the winter feeding of dairy herds on all the drier land.

During this rapid expansion a good deal of experience in the production and utilization of this important crop has accumulated, and the object of this article is to place on record Dorset experiences.

As a provider of milk food, grazed kale has few rivals. Quantitatively an acre provides as much starch equivalent as 1½ acres of barley. In other words, a 15-utilized-tons per acre crop of kale supplies a little over 3,000 lb of starch equivalent and a 25-cwt crop of barley gives a little less than 2,000 lb starch equivalent. Furthermore, the value of the 470-lb protein equivalent in such a crop of kale is most significant in the production of milk, and helps to balance other home-grown foods and cereals, often to provide a balanced diet for two gallons of milk per cow. Not only are the yields of milk-producing food high with kale but the costs are low. Indeed, grazed kale is second only to grazed grass as a provider of cheap starch equivalent.

Boden[1] gives the following comparative figures, taking the cost of starch equivalent from grazed grass as one: grazed kale 1·8, grass silage 2·1, hay 2·2, cut kale 2·6, arable silage 3·9, mangolds 4·4, dairy cakes 6·8.

Low cost

Dorset experiences confirm the low cost of this crop which is so important these days. On many Dorset farms grazed kale is being produced for as little as £1 per ton utilized, the general run of costs varying from £14 up to £20

per acre, but on strong difficult land, where there are serious weed problems and where kale has to be carted, costs are much higher. Dorset farmers try to use kale as a quality roughage which is grown to make a contribution not only to maintenance but also to production.

Beynon[2] has calculated that where the crop was used to replace dairy cake on small farms if the holding was understocked, two acres with a utilized yield of 12 tons per acre would give an additional net farm income of £95 per year, whereas on a fully-stocked small farm where kale growing meant perhaps a restriction of stock, it would still be beneficial to the net farm income to the tune of £28 a year. Since the majority of kale grown in Dorset is on larger farms which are not overstocked, it plainly makes a real contribution to the net income derived from milk, and this indeed largely accounts for the big rise in acreage during recent years.

Where total outwintering is possible such conditions provide the greatest scope for maximum kale usage, and many of the dairy cows in the county have a liberal allowance of grazed kale throughout the whole of the winter. Many herds have kale until about the end of January, and we estimate that at least 80 per cent of the herds in the county have kale at some time during the winter. In addition, on 20 per cent of the farms, mostly on the drier chalkland, kale plays an important part in wintering dairy heifers and sometimes steers from the dairy herd. Only on the wet vale farms do we find all-grass systems. Everywhere else kale is grown, sometimes as the only crop on the farm other than grass. It is also a popular crop with swedes among farmers who still have arable flocks of sheep, for it is especially liked for fat lamb production with autumn-born lambs.

Marrowstem and thousandheaded are the varieties most widely grown, and together make up 85 per cent of the total acreage. About one-third of the farmers who grow kale prefer marrowstem only, several experienced growers considering it to be the most palatable. Under one-third feed marrowstem up to Christmas or early January, and then go on to thousandheaded, which holds its leaf rather better during late winter. One of the best growers in the county sows a small acreage of a mixture of marrowstem and thousandheaded for the change-over. Canson is increasing in popularity, but still represents less than a tenth of the total acreage. There are a few farmers who grow only thousandheaded, and some who grow a mixture of thousandheaded and marrowstem or even rape and marrowstem. A few, too, grow hungry gap for very late feeding.

A large percentage of the kale acreage follows grass. It usually follows a ley but it is also a popular crop after permanent pasture and on land which has recently been reclaimed. Often, two crops of kale are taken before sowing to a cereal or reseeding. Kale is considered an excellent crop to utilize the reserve of fertility built up by a ley and can make good use of nitrogen left by the clovers.

Weeds are a problem, but . . .

Weeds, mainly charlock, redshank and fat-hen, are frequently a problem in kale and a large acreage is sprayed with sulphuric acid. As most farmers dislike using acid, almost all the spraying is done by contractors. Acid is normally applied at high volume, using 7½–10 gallons b.o.v. in 90 gallons

water per acre, but one contractor in the county uses neat acid at 10 gallons per acre quite successfully. During last summer one farmer applied neat acid with his own low volume machine, but with limited success. His main problem was blocked sprayer nozzles, and he found it necessary to strain the acid through a fine gauze filter. The stage of growth of the kale is more critical when neat acid is used and results so far, although encouraging, have been rather more variable than with the normal high volume method of application.

A new material, monochloracetate, was introduced last year and used on a limited scale; it gave a good control of charlock and redshank, but was quite ineffective against fat-hen. Monochloracetate may be applied with any standard low volume sprayer, it is inexpensive, and being easy to handle has already raised a good deal of interest among farmers on the chalk, where charlock is the principal weed.

. . . *later sowing allows cleaner seedbeds*

The majority of crops are now fed *in situ* and this has tended to lead to later sowing. Only a quarter of the total acreage is sown before midsummer. Considerably more than half is sown during late June and rather less than a quarter in July. Later sowing allows the land to be well cleaned, for the production of a weed-free seedbed is an important aim in Dorset practice. When kale follows a tillage crop the land often gets several ploughings, and a seedbed is prepared as early as May and periodically cultivated until sowing time. This pattern of husbandry is designed to produce a good leafy crop suitable for grazing, using an electric fence. Three-quarters of the crops are drilled to allow inter-row cultivations with steerage hoes, and to assist in fencing and rationing the crop. The usual seed rate is 3–4 pounds an acre and in some cases is as low as 2 pounds. For broadcast crops seeding is usually between 6 and 8 pounds per acre.

The majority of the county's kale acreage receives a seedbed dressing of 4–5 cwt per acre of No. 1 complete fertilizer. Few crops get a larger dressing except those following a tillage crop, when it is usually 7–8 cwt of complete fertilizer per acre. About half the acreage receives a top dressing of nitrogen, in about 2 cwt per acre of sulphate of ammonia or its equivalent. One experienced and successful grower applies all the nitrogen as a top dressing, because he feels nitrogen in the seedbed increases early weed competition. Nitrogen is often withheld altogether from crops to be fed after Christmas as it is considered that it reduces the plants' resistance to damage by frost.

Use of the electric fence

The acreage grown ranges from about a fifth to half of an acre per cow, but on most kale-growing farms about a third of an acre per cow is allowed. Experiences and opinions on the use of the electric fence differ widely. The most popular method is to run the fence immediately in front of the crop and allow the cows to feed underneath it. Five yards per cow is regarded as a reasonable allowance, although many farmers feed a shorter face quite successfully, especially where cows are dehorned. A long feeding face greatly reduces the chances of the fence being broken or pushed down. One farmer

has overcome this difficulty by using electrified posts. It is often extremely difficult to graze a tall crop by this method as the stalks tend to be pulled across the wire, and cattle very quickly break through. Rather less than half the growers prefer to use the fence immediately in front of the crop, and about a third move it back into the crop each day. Many who normally use the fence in front of the feeding face will adopt the latter method in tall crops. Some grow a row of swedes at intervals of four to five rows of kale to avoid cutting out a row of kale for the electric fence, and a few feed in blocks. In the block method a track 60 or 70 yards long is cut in the crop parallel to the feeding face, and the blocks are isolated by cutting further tracks at right angles to the feeding face. Most farmers fence off a block of sufficient size to last the herd for one day's grazing, but a few prefer larger blocks and move the fence every two or three days only. This especially applies where heifers and steers are being grazed.

Avoiding waste

It is not always appreciated how much waste can occur in kale grazing, and that it is the utilized yield that really matters. The careful use of the electric fence can do much to reduce loss. There is little doubt that the most wasteful method of grazing kale is the use of the block system. Where the fence is moved every two or three days only, little more than half of the crop may actually be consumed by the herd. It is estimated that where the fence is moved about six feet into the crop each day the amount actually utilized is about 65 per cent. The most economical method of feeding is by moving the fence up to the crop, when a utilization of about 75 per cent may be expected. This can be improved still further by moving the electric fence twice a day. Possibly the most efficient case of utilization seen this winter was where the fence was moved three times a day, when the figure was estimated to be over 80 per cent.

The estimated yield of well-managed kale in Dorset is about 20 tons per acre, but the utilized yield varies from 12 to 16 tons per acre according to the method of grazing and the leafiness of the crop. A very efficient means of feeding is by cutting and carting, but the gain is greatly outweighed by the cost of labour involved, and is only done in Dorset on the heavy-land farms where grazing is not practicable. On one such farm a cut rake was found to reduce the cost of the operation. Most herds have free access to the kale during the day, and with the remainder access is restricted to about an hour —usually in the morning but sometimes twice a day.

Almost all farmers expect their kale and a small amount of hay to provide at least maintenance and the first gallon of milk. About 25 per cent look for the first 1½ gallons, and a few get maintenance and 2 gallons by using very good quality hay and a small amount of home-grown cereal. The most that is expected from newly-calved and high-yielding cows is maintenance and 1½ gallons. Very few farmers feed silage before Christmas, but the majority who feed kale throughout the winter introduce silage into the diet early in the new year. Most farmers feed a little hay before allowing the animals on to the kale, especially during frosty weather. It is considered most important that cows should always have access to a good supply of drinking water during kale grazing.

Overcoming the drawbacks

Despite many virtues, kale grazing is not without its drawbacks. In large crops, especially early sown ones, stumps left by the cows can be a nuisance and extremely difficult to deal with when preparing the land for a subsequent crop. One Dorset farmer has overcome this problem by pulverizing the uneaten stumps with a potato haulm destroyer.

On loams and heavier soils it is often difficult to prepare a good spring seedbed after the land has been heavily trodden. For this reason some like to finish their kale by January. A very efficient way of overcoming this, among farmers who graze kale throughout the winter, is to plough fairly close behind the herd and use a back fence to prevent the newly-ploughed land being damaged. By this method only a very small acreage is left for ploughing late.

During wet weather and again on the heavier soils, mud is a major problem; cows can get extremely dirty, and then a great deal of extra time has to be spent in cleaning and preparing for milking. Cracking teats frequently accompany this mud problem. The practice of restricting the time the herd spends at the kale face has much to recommend it in minimizing these troubles; it also reduces the amount of treading the land receives. When the soil is wet, foot troubles too have to be watched carefully, but many farmers have overcome them very successfully by making the herd pass through a foot-bath when entering the yard for milking.

There are always the occasional cases of bloat but these are surprisingly few, considering the scale on which the crop is fed. The feeding of a little hay before allowing the cows to graze the kale is claimed by many to reduce the risk of this trouble greatly.

By yielding about a quarter of a million tons of cheap and effective food to some 60,000 dairy cows, grazed kale makes a real contribution to the economy of farming in a county where milk production is the most important source of income. The crop may well have to play a greater part nationally if British farmers are to maintain their incomes from milk.

References

1. S. M. Boden. *Information*, West Riding A.E.C. **11**, No. 4.
2. V. H. Beynon. *Economics of Animal Nutrition*, N.A.A.S., S.W. Region Course, November 1954.

It is with deep regret that we announce the death of Mr. R. Garside, one of the authors of the above article, on 7 March.

Farm Machines in Good Order

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In spite of the increasing importance of mechanization, little information is available about the costs of keeping farm machinery in running order. This article discusses these costs for some of the more common machines and implements.

A FEATURE of present-day agriculture is the interest which the majority of farmers take in everything mechanical. This interest is stimulated by agricultural shows, the farming press, trade catalogues and the activities of local dealers, all providing specifications and prices of farm machinery. In contrast, little is heard or written about the costs of keeping machinery in running order.

The cost of repairing and overhauling farm machinery provided the subject for a recent Yorkshire survey in which 118 farmers co-operated. Most were farming 150–350 acres in the arable districts of the county. They provided details in a postal questionnaire of the annual repair costs and the number of days' use a year, for a variety of machines and implements. The list covered was by no means exhaustive, but with the exception of tractors and combine harvesters, most of the important items of farm machinery were included. The results of this inquiry are summarized below.

Cultivating machines

The maintenance of tractor ploughs, ordinary harrows, cultivators and gang rollers consists mainly of running repairs. Ploughshares, breasts, grounds and discs, harrow teeth and cultivator shares all need regular replacement. Bent and broken frames require attention.

The working parts of these machines require renewal at regular intervals, the length of the interval depending to some extent on the kind of soil. Where there are many stones in the soil, breakages and bending are commonplace, and on sandy soils metal surfaces are quickly worn. An example of the effects of soil type is given by the life of ploughshares; an iron share costing about 7 shillings lasts approximately one day on Yorkshire Wold farms (chalk with flints), two days in the Vale of York (predominantly light sandy soils) and nearly three days on the heavier loams and clays of Holderness.

Repair costs per day used on all soil types averaged 10*s.* 8*d.* for a tractor plough, 10*s.* 2*d.* for a set of ordinary harrows, 9*s.* 9*d.* for a cultivator, and 4*s.* 10*d.* for a set of gang rolls. Harrows and cultivators, of course, cover a much larger area in a day's work than ploughs, so their repair costs per acre are considerably lower.

The working parts of disc harrows require renewal in the same way as those of other cultivating machinery, but their life is a matter of years, not days. Consequently repairs to discs mainly consist of major overhauls costing up to £30. These are associated with the renewal of the actual discs,

which generally wear down evenly and are replaced at the same time. Running repairs are relatively unimportant. Over one-third of the disc harrows in the survey incurred no repair costs during the year; by contrast, about one-fifth received major overhauls.

The following table, which is taken from the Leeds University report referred to on page 24, gives average repair costs per day and per acre for the various implements and machines discussed. The daily costs are the actual costs obtained in the survey; the acreage costs are calculated on standard rates of work per day taken from an earlier Yorkshire study, which covered some of the farmers who co-operated in the present survey.

Average Repair Costs per Implement
1956–57

	Number of 8-h days used a year	Repair cost per 8-h day	*Acres per 8-h day	Repair cost per acre
		s. d.		*s. d.*
Tractor ploughs	21	10 8	3	3 6½
Disc harrows	13	7 2	11	8
Ordinary harrows	8	10 2	16	7½
Cultivators	10	9 9	11	10½
Gang rollers	11	4 10	24	2½
Ordinary fertilizer drills	12	5 8	11	6
Combine drills	10	14 0	8	1 9
Mowing machines	7	13 8	8	1 8½
Hay tedders	6	4 10	16	3½
Swath turners/side delivery rakes	7	7 7	16	5½
Hay rakes	5	3 11	16	3
Binders	6	33 11	8	4 3
Pick-up balers				
baling hay	7	26 8	8½	3 1½
baling straw	11	26 8	11	2 5

* Working rates for pick-up balers are averages returned in this investigation. Working rates for other implements are based on figures published in: *The Use of Labour in Yorkshire Farming. University of Leeds, Department of Agriculture, Economics Section Farmers' Report 130.* Nov 1956.

Fertilizer and combine drills

Repairs to these implements depend to a large extent on the maintenance standards adopted by their users. Fertilizers quickly corrode metal surfaces, and the intricate seeding mechanism of a combine drill may be ruined if the machine is stored dirty for any length of time. Cleaning, repainting, the avoidance of working and storing under damp conditions, all help to reduce corrosion. It is virtually impossible, however, to keep drills clear of fertilizer, so some damage is inevitable. Maintenance labour on combine drills averaged two hours each day the implement was in use. This includes a share of the time spent in "spring cleaning" the machine after the working season is over.

Repair costs per day used averaged 5*s.* 8*d.* for ordinary fertilizer drills and 14*s.* for combine drills. These figures conceal a considerable variation in expenses between farms. Work on the ordinary drills consists mainly of running repairs and the renewal of small items; the variation in the costs was partly a reflection of differences in maintenance standards. Some of the

combine drills, on the other hand, had major overhauls costing up to £40, which included major items of renewal. These costs were exceptional: most combine drills incurred only minor repairs and renewals.

Haymaking machines and pick-up balers

Repairs on such machines as tractor mowers, hay tedders, hay rakes, side delivery rakes and swath turners, come mainly under the heading of running repairs. Their annual cost depends largely on the amount of use the implement receives in a working season.

Repair costs on hay rakes and tedders averaged no more than 30*s.* a year a machine. Quite a proportion of these implements, especially those which were not used much, cost their owners nothing in repairs in the year under review. Swath turners and side delivery rakes were rather more expensive, broken and bent tines being the main trouble. Of this class of machinery, mowers are the most costly to keep in repair. Their cutter-bars are a continual source of expense, knives are worn down, and fingers and sections have to be replaced. Mower knives are especially vulnerable to damage by stones, so it is probably no coincidence that Wold farms returned higher costs than the other farms of the survey. Costs for the sample as a whole averaged 13*s.* 8*d.* each day that a mower was in use.

Because of the number and complexity of the working parts of a pick-up baler, it is difficult to comment very briefly on repairs to this machine. Needles, knotters, knives, baling tines, rams, driving belts and chains, and if self-powered, engines, are all liable to be damaged. The chances are that in any one season trouble will be confined to a few of these items only.

Repair costs were obtained from twenty balers. Costs per baler varied considerably. Two had major overhauls costing about £100; another three (new and in their first working season) incurred no repair costs at all. The rest had annual repair charges varying from £10 to £25.

All this confirms the impression that new balers require little attention; after the first year charges mount up until, in perhaps five to seven years, an expensive overhaul is necessary. There is a growing tendency, however, for farmers faced with major repairs to expensive machines like balers to avoid these charges by trading in their old models in part exchange for new machines.

Binders

Binder repairs fall into two categories—ordinary running repairs and major overhauls. Running repairs are mainly concerned with cutter-bars and knotter mechanisms. Binder knives, although a source of expense, normally give less trouble than mower cutter-bars since they are set higher off the ground. Major overhauls are usually associated with the renewal of canvases, a complete set of which can cost from £20 to £30. Although careful use and storage can prolong their life, they deteriorate with age whether the binder has been used or not. In the sample, one-fifth of the binders had major overhauls in the year, a figure which, assuming an even age distribution, suggests major replacements every five years or so.

Binders returned the highest repair costs per day used (£1 13*s.* 11*d.*) of all

the machines covered in the present study. This high figure results from heavy annual repair bills and a low rate of annual usage. Binders averaged only six days' work a year; a reflection of the number of farmers who depended primarily on combines for their corn harvest and used their binders in a subsidiary capacity. Labour time on maintenance (not included in repair costs) averaged two hours for each day that the binder was in use. This covered the work involved on maintenance in the field, and an allowance for the time spent preparing the binder at the start of the harvest season and dismantling it afterwards.

For a more detailed account of the survey, especially where cost figures for individual machines are concerned, the reader is referred to a report published by Leeds University—*The Cost of Repairs and New Parts for Farm Machinery* (Farmers' Report 137, Nov 1957), by Morag C. Mathieson. Price 3*s*. (3*s*. 3*d*. by post).

Wrought Ironwork

DAVID C. THOMAS

Rural Industries Bureau

Wrought ironwork is coming into its own again. The demand for it is growing, and the Rural Industries Bureau is encouraging and helping many smiths to take up the challenge to their skill and artistry.

WROUGHT ironwork, like many "rural" trades, is carried on in big cities as well as in country towns and villages. The fact that it is practised in the countryside today is due partly to the attraction of lower rates and overheads, and also to the ebbing demand for traditional smith's work, which has compelled many established craftsmen to seek new outlets for their skill. Last year 134 wrought iron smiths were visited by the specialist instructors of the Rural Industries Bureau.* These men form the core of the trade in so far as it is carried out in the country, and are made up partly of specialists, some of them artist-craftsmen or townsmen who have settled in the country, but more particularly of blacksmiths who, though perfectly at home with welding sets, lathes and drills, are trained in working hot metal on the anvil and are anxious to develop this skill to their advantage.

The capital equipment of a wrought iron smith is fairly simple, and has changed little since Anglo-Saxon times. It consists first of a hearth—usually a deep cast-iron tray standing on a brick or iron substructure and containing a fire of smithy nuts or coke breeze. Over the hearth is a hooded flue-pipe, and from the rear the blast-pipe, called the *tuyère* or tue-iron, projects into the heart of the fire. The air blast comes from an electric fan, the bellows being little more than a memory. In front of the hearth is a trough of water for cooling and tempering the metal and controlling the fire by literally "damping" it, to restrict it to a small area of the hearth.

* Elementary instruction is given by the Bureau to a number of engineer-smiths, in addition to those mentioned above.

Close by, and accessible by a turn of the body, is the anvil. This is of steel or wrought iron steel-faced, and is mounted on a squared-up elm trunk which, a smith will say, gives the anvil a lively rebound at each hammer-blow. In its flat face are two holes—a round one (the pritchel hole) for punching, and a square one (the hardie hole) for the shank of a fixed tool. The tapered end or bick of the anvil is the part over which metal can be bent to circular forms. Other fixed gear includes a heavy bench and vices where work can be held during drilling, filing or the cutting of screw threads.

Tools and templates

The smith's tools must include shears for cutting the metal, hammers, punches, chisels, dies and mandrels for working it, tongs, rakes and a shovel for maintaining a clean fire, and callipers, squares, scribers and dividers for measuring and marking-off. Other tools include swages, which are grooved dies used in pairs for forging variations in the cross-section of bars. The lower swage has a shank to fit the hardie hole, which holds it rigid, while the upper swage, which is fitted with a helve or handle, is held by the smith and struck by the hammerman or striker, the work-piece being formed between the two. There will also be a swage block near to the hearth. This is a heavy casting pierced with round, oblong and square holes for tools and for various forming operations (like the anvil), and bearing along its edges grooves of various profiles which are similar in purpose to individual swages. Fullers are tools used in pairs like swages, but are of convex profile, while hardies, sets and chisels are cutting tools variously formed for use on hot or cold metal.

It will be seen that most of these tools are used in conjunction with the pre-eminent instrument of the blacksmith's trade, the hammer. The largest of these are sledges (up to 20 lb) and are wielded by the blacksmith's striker. Then there are smith's hammers (2–7 lb), ordinary engineer's hammers and a range of flat, convex and ball-headed types.

Most of the tools described are true blacksmith's tools, and are used equally in general smithing and wrought ironwork. Coming to the particular needs of the wrought iron smith, it is important that he should possess an iron-topped table for marking-out his work. He will also have a variety of forming tools or jigs for making scrolls, most of which he will have made himself. If he is going to carry out repoussé work, that is, the embossing of sheet iron or mild steel, he will need a pitch block and sandbag, with a blowpipe and special hammers and punches. This branch of smith's work has been neglected lately, and is full of possibilities for craftsmen with original ideas.

Basic blacksmithing

Skill in forging and fire-welding lies at the root of the smith's art. His fire should be a glowing core, small and free from clinker which can spark up and cling to the hot metal. Smiths have a name for at least eight degrees of heat. "Warm" heat (used for setting up springs) is just too hot to touch; "bright red" heat is used for forging mild steel; "light welding", "sweating" or "slippery" heat, at which the metal is very light yellow, is used for

forging wrought iron. Hottest of all is white or "snowball" heat, used for welding true wrought iron, while between those named come "black" heat, "blood-red" heat, and "full welding" heat. Before taking up wrought ironwork a smith will have mastered the basic operations of traditional blacksmithing. Chief among these are "drawing down" or lengthening a bar of metal while at the same time reducing its cross-section; bending, best done at a bright red heat; and "upsetting" or "jumping-up", which means the thickening up of a bar at the place where it is going to be bent, so that its cross-section after bending will stay constant throughout and not be reduced by stretching.

Among the many methods of joining metal, fire welding must be mastered. The metal is prepared by scarfing—that is, overlapping the two pieces to be joined after thickening or upsetting them so that the eventual thickness of the joint will be no smaller than that of the rest of the bar. The heat required will vary between light welding and snowball heat, and the two parts must be withdrawn smartly from the fire and immediately hammered together, lightly at first and then with the heavy blows which are needed to drive out impurities and give a continuous grain across the joint. The final blows will also give the metal its finish, and there is a good deal of argument as to whether or not the marks of the hammer should be in evidence.

Scrolls and lively workmanship

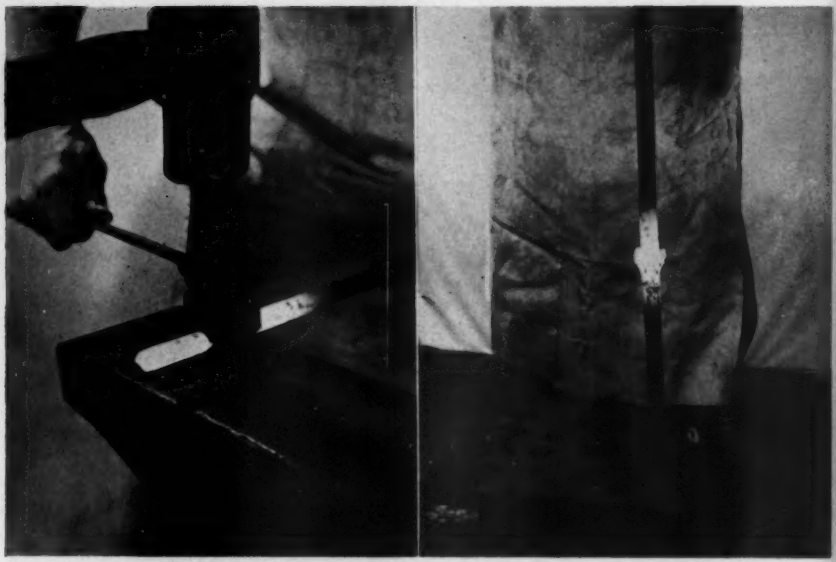
Another branch of traditional wrought ironwork calling for high skill is the forging of scrolls. These can take many forms—there are "C" scrolls, "S" scrolls, fishtail-end scrolls, bolt-end scrolls, bevelled scrolls and many more. If they are forged from the hot metal without too much regard for exact symmetry and repetition, a far livelier effect will be produced than in a gate or balustrade where cold-bent scrolls of identical shape have been prepared on special jigs. For several decades too much regard for mechanical symmetry has had a numbing effect on wrought ironwork, and the Rural Industries Bureau's master-craftsmen, in conjunction with qualified designers, have recently been working on new forms in which liveliness of workmanship rather than mechanical perfection has been aimed at. In many of these there has been no effort to hide the marks of the hammer, and the result has been a scintillating play of light and shadow on the surface of the metal.

Many other operations must be mastered by the wrought iron smith before he can be entrusted with a sizeable gate or balustrade. For joining metal there are many techniques besides fire-welding. These include riveting, collaring, bolting and pinning. The use of collars, which are often seen joining "C" scrolls back-to-back, not only gives an effective joint, but adds richness to the silhouette of a gate. Riveting and screwing are among the numerous jobs which must be done on the bench, and which demand skills more like those of an engineer. Marking-out, drilling, tapping, filing and the production of the final protective coating come into this category. The latter is of special importance now that true wrought iron is an expensive and rare commodity. Mild steel (which is what is nearly always meant today when the words "wrought iron" are used) has nothing like the same resistance to corrosion. It can be polished (when it is described as "armour bright"),

Photo: *Rural Industries Bureau*

Sussex Smith

Mr. Ken Grantham, of Ashurstwood near East Grinstead, is one of the new generation of skilled ironsmiths.



(*left*) A pair of swages, and (*right*) a swage block in use. The holes in the block are for tools and various moulding operations and the grooves along its side are used, like the pair of swages, for shaping bars into new cross-sections.

Photos: *Rural Industries Bureau*

(*left*) "Upsetting" or "jumping up" a bar where a bend is to be made. (*right*) Detail of a grille made by one of the R.I.B.'s specialists. No attempt has been made to hide the marks of the smith's tools.

Variety Trials with Dutch Threshed Peas (Article on pp. 34–7)

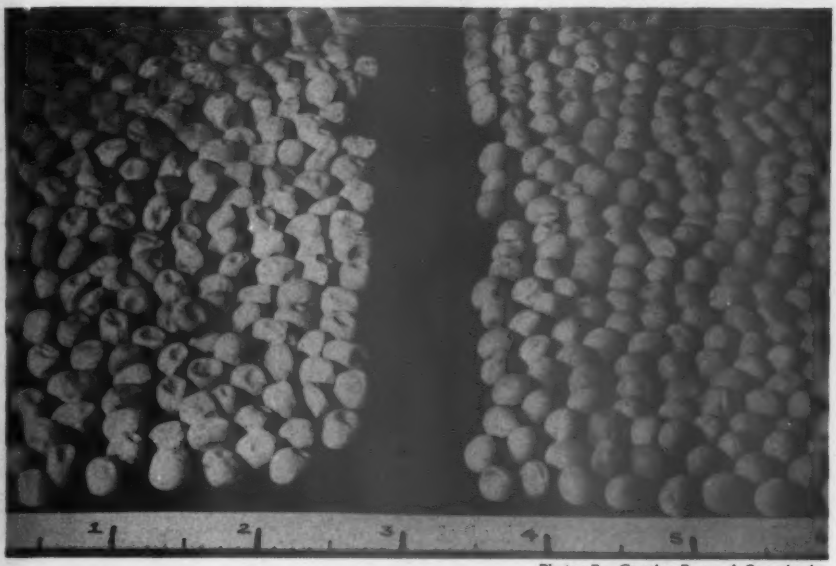


Photo: *Pea Growing Research Organisation*

(*left*) Zelka, a marrowfat, widely-grown for harvesting dry. (*right*) Unica, a large blue, one of a group which outyields the marrowfats and may give higher returns on better-than-average land.

Weeds: The Ancient Enemy (Article on pp. 5–8)

Photo: *Plant Protection*

The sprayed and the unsprayed. Charlock in wheat controlled by an MCPA selective weed-killer.

Photo: *N.I.A.*

Seed Control: Present and Future (Article on pp. 13–16)

Seed examination at an official seed testing station. A count of dodder seeds in a sample of red clover.

lacquered, treated with oil, or painted after priming with an oxide or other metallic paint.

Rediscovering the medieval magic

In the last ten years there has been a revival of interest in hand-forged architectural wrought ironwork, not only of "traditional" type, but of new and original character. The same period, however, has brought an unprecedented growth of commercial products masquerading as wrought iron, in which cold-formed scrolls of sheet metal are spot-welded to form flimsy ribbon-like fabrications. No one who has had to fumble for the latch of a gate made of this kind of wrought iron on a wet night is likely to forget the experience. Such objects, and the toasting-forks, lanterns and wind-vanes poured out from the same sources, have very little to do with the robust tradition of the English country ironsmith. Though paradoxical, the truth may be that to recapture tradition, we may have to abandon it—that is, shed our illusion of what is "traditional" and look again at the finest medieval work, like the Eleanor grille at Westminster or the one from Chichester Cathedral, now at the Victoria and Albert Museum. These remind us that wrought iron, however decorative, was once either structural or protective—hence the spiky angularity of much early work. This spare, irregular, even nervous quality is sadly lacking in modern ironwork, but there are signs that young designers are aware of its importance.

Grassland Irrigation

C. A. JEWELL, B.SC.(AGRIC.) and R. S. TAYLER, B.SC.(AGRIC.), N.D.A.
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Irrigation is not only an insurance against summer drought. It can be a major factor in maintaining milk yields after the spring flush.

THE Sonning Farm of Reading University has been aptly described as "a heap of sand and gravel". As on most light land in the south and east of England, any advantage from easy cultivation of the soil may be offset by the problems associated with an inadequate rainfall. Here, in mid-Berkshire, the average rainfall is 25½ inches. Only about 12 inches falls from April to September, but during these six months loss of water from the soil by transpiration through a green crop can amount to 18 inches—6 inches more than the expected rainfall. This difference seriously limits grass production in nine years out of ten. The only remedy is to irrigate the land.

The first requirement of irrigation is a plentiful source of water; 5 inches of water on 50 acres equals nearly five and a half million gallons. In this respect Sonning Farm is favourably situated. A hundred acres of meadow

land lies alongside the Thames, and during the past two seasons we have been able to irrigate half this area by pumping river water through overhead sprinklers.*

The second requirement, after deciding how much land can usefully be irrigated, is to have enough equipment to maintain the soil near field capacity. (Field capacity is the maximum water which the soil will hold against the pull of drainage.) This, in our experience, is important if full advantage from irrigation is to be obtained. To keep the grass leafy and growing fast all through the summer, there must be no check to growth such as may occur if the soil is allowed to dry out too much between irrigations. Under our conditions, it seems desirable to keep the soil moisture deficit (the amount by which soil moisture is less than field capacity) at not more than 2½ inches and not less than ½ inch. On other soils 3, or even 3½, inches may be a sufficient standard.

In order to keep pace with an increasing soil moisture deficit on 50 acres of grassland, we have used an 11 h.p. diesel pump at one of two positions on the river bank. From either of these sites the farthest points can be reached by a 3-inch main line. A 3-inch lateral line takes twenty sprinklers spaced at 35 feet. With this equipment, one inch of water can be applied to an acre in three hours.

Moving the lateral line takes only a few minutes, but frequent moves may produce problems of labour organization. Unless the man responsible for shifting the equipment is working on his own near by, time is consumed in getting from one job to another and the work of a gang may be interrupted. One way out is to combine the task with topping, top dressing, electric fence moving, or other work in the same area. Another is to ensure that all the men on the farm know how to do the job and to make pipe shifting the responsibility of whoever is working nearest the equipment.

Frequency of irrigation

The frequency of irrigation will naturally vary with the weather. At the beginning and end of the season, and during showery weather, an inch every two or three weeks may be all that is required to bring the soil to ½ inch short of field capacity. Waiting until a deficit of 2½ inches occurs, particularly in the early part of the season, results in an alarmingly high deficit being built up before the whole area can be irrigated. The principle is the same as the need to start strip grazing a field before optimum growth.

In June and July, when transpiration is usually at its highest, 2 or more inches of water may be needed at a time. This involves six or eight hour periods of irrigation, making the moves less frequent and easier to deal with. In addition, pumping day and night during very dry weather may be necessary to keep pace with a soil water deficit increasing at the rate of an inch per week. This puts up the overtime bill and is an added commitment at a busy time of year.

It will be clear that some guide to the moisture content of the soil is required in order to avoid too much or too little irrigation. The best method is to keep a field record of water gains and losses. The gains are amounts of

* We wish to acknowledge with thanks the co-operation of the Thames Conservancy Board during the course of these investigations.

irrigation and rainfall (a rain gauge is an essential part of the irrigation equipment). Loss of soil moisture is due to transpiration through the plant. Provided there is moisture in the soil, the rate of loss in established grass (or any green crop which completely covers the ground) is governed by weather conditions, the chief variable being the number of hours of sunshine. Tables are available for different parts of the country showing the average potential transpiration for each month.* During any month the *average potential transpiration* minus the rain that has fallen is used to indicate the irrigation need. At the end of the month the *actual potential transpiration*, a figure which can be obtained through the N.A.A.S., is used to correct the estimate of soil moisture deficiency. The corrected figure is then used for the start of the next month. The balance sheet below, which is explained on page 30, shows the conditions for one field at Sonning Farm during 1957.

Soil Moisture Balance Sheet

Sonning Farm 1957. Thames Meadow
(*All figures are in inches of water*)

Period		Average potential transpiration (E. Berks)	Rainfall	Rain deficit	Estimated soil deficit before irrigation	Irrigation applied	Soil deficit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
April	1–15	0·90	0·04	0·86	0·86	—	0·86
	16–30	1·05	0·30	0·75	1·61	—	1·61
		1·95			Correction for April		0·10
							1·71
May	1–15	1·50	1·09	0·41	2·12	1·50	0·62
	16–31	1·70	0·19	1·51	2·13	1·50	0·63
		3·20			Correction for May		Nil
							0·63
June	1–15	1·90	1·30	0·60	1·23	—	1·23
	16–30	1·95	0·96	0·99	2·22	1·50	0·72
		3·85			Correction for June		0·55
							1·27
July	1–15	2·00	2·22	−0·22	1·05	—	1·05
	16–31	1·90	2·26	−0·36	0·69	—	0·69
		3·90			Correction for July		−0·40
							0·29
August	1–15	1·60	2·24	−0·64	Nil	—	Nil
	16–31	1·55	0·42	1·13	1·13	—	1·13
		3·15			Correction for August		−0·15
							0·98
September	1–15	0·90	1·40	−0·50	0·48	—	0·48
	16–30	0·80	2·04	−1·24	Nil	—	Nil
		1·70			Correction for September		−0·20
							Nil

* The Calculation of Irrigation Need. *Ministry of Agriculture Technical Bulletin No. 4*, price 2*s*. (by post 2*s*. 3*d*.).

As an example of how the balance sheet is made up, take the situation at the end of April, 1957. The soil deficit (column 7) was then 1·71 inches. The average potential transpiration for May was divided between two fortnightly periods. In the first half of May, an expected transpiration loss of 1·50 inches (column 2) was partly offset by 1·09 inches of rain (column 3), leaving a rain deficit of 0·41 inches (column 4). The estimated soil deficit (column 5) was, therefore, 2·12 inches (1·71 inches plus 0·41 inches). During the same period 1·5 inches of irrigation was applied (column 6), which reduced the soil deficit at mid-May to 0·62 inches (column 7). The figures for the second half of May are calculated in the same way, and since the actual potential transpiration figure for May (supplied by the N.A.A.S.) was the same as the average figure initially employed (3·20 inches), the correction for the month was nil. All this may seem a little complicated, but in practice it is easily carried out and the continuous picture it provides helps one to make the best use of the equipment and labour available.

The Sonning story

Field trials during 1955 and 1956 at Sonning have shown that, with frequent irrigation and generous nitrogen manuring, the production of dry matter from grassland can be doubled.* On a commercial scale rather less spectacular results of between 30 and 60 per cent increase may be obtained, but greater production of grass is not the whole story. Continuous young, leafy growth of grass throughout the summer gives improved quality of feed and has been a major factor in maintaining the milk yields after the spring flush, when they might be expected to fall off. This improved quality is reflected both in the contribution grassland has made to summer feeding and in the saving of concentrates in the past two irrigation years, 1956 and 1957, as compared with the two previous years when no irrigation was used.

	1954	1955	1956	1957
Number of weeks that grass provided for maintenance *plus* 4 gallons or more	17	11	24	26
Rainfall, April–Sept (inches)	14·50	9·42	13·55	14·43
Pounds of concentrates fed per gallon of milk sold (April–Sept)	1·18	1·38	0·97	0·48

The field trials have also shown that irrigation has had the effect of breaking down dung pats and grass toppings more quickly. With frequent grazings of the same unirrigated sward, the amount of wasted grass due to soiling has risen from 20 per cent to as much as 84 per cent towards the end of the season. On irrigated swards the wastage remained at about 25 per cent all through the season, perhaps because of the increased palatability of the grass as well as the decontaminating effect of the water.

On reseeded swards particularly, the rate of deterioration has been arrested, and indeed the proportion of better grasses has tended to increase. Clover also has been well maintained at levels of nitrogen top dressings which, without irrigation, would have suppressed the clover altogether.

On irrigated pastures, a basic spring dressing of 3 cwt of compound fertilizer and 2 cwt of ammonium sulphate per acre has been applied. In addition, an average of a further 5 cwt of ammonium sulphate per acre has

* I. Munro 1957. Unpublished thesis, Reading University.

been used during each season to exploit the irrigation carried out. Only a small part of this extra nitrogenous fertilizer would have been used without irrigation, and then only in very favourable seasons, so that in the irrigation costs which follow, the figure for fertilizer represents the cost of this additional manuring.

	1956	1957
Area of irrigated grassland (*acres*)	47	50
Average inches of water applied	6·3	3·8
TOTAL COSTS	£	£
Irrigation		
Manpower	70·0	64·4
Tractor	9·7	9·4
Pump fuel	46·4	26·4
Depreciation of equipment (15 *per cent*)	107·1	116·2
	233·2	216·4
Fertilizer	223·4	187·7
COST PER ACRE		
Irrigation	5·0	4·3
Fertilizer	4·7	3·7
	9·7	8·0
COST PER ACRE INCH	*s.*	*s.*
Irrigation	15·7	22·5

Assessing the gain

There is no easy method of assessing directly the gain which we expect to offset the cost of £8–£10 per acre for irrigation. However, there are a number of ways of arriving at an estimate which at least gives confidence that the enterprise has been worth while.

Firstly, on the basis of the field trials already mentioned, it is not unreasonable to assume an extra ton of starch equivalent per acre from the irrigated grassland. At 8*s.* to 10*s.* per cwt, this is cheap food. Secondly, during 1954 and 1955, without irrigation, the average milk production on Sonning Farm was 30,565 gallons for the six months April to September. In the next two years, with irrigation, the average during the same months rose to 37,745 gallons. The extra production was achieved without devoting more land to the dairy herd, the only major change having been the introduction of irrigation. At the same time, there was a substantial saving of concentrates, averaging about 5 tons per year during the April to September periods of 1956 and 1957. Assuming that an increase of only 5,000 gallons may be attributed to irrigation coupled with higher nitrogen applications, at 2*s.* 6*d.* per gallon this represents a return of £625. If the value of saved concentrates, say £150 per year, is added to this figure, a total of £775 is reached which can be set against an annual outlay of about £450.

It must be emphasized that these figures have not been obtained under controlled experimental conditions, and to that extent their exact value must remain in doubt. Nevertheless, they are worthy of note, and show the need for further investigations.

Lastly, the cost of irrigation can be viewed as an insurance premium against summer drought, and at Sonning it represents 1¼ per cent of the gross farm output. This is a small price to pay for security against the risk of a

shortage of keep which must otherwise be covered by devoting more land to grass and fodder crops. During the past two years we have, in fact, been able to release land, which previously had been devoted to the dairy herd, for corn and other cash crops.

Work Study in Agriculture

NIGEL HARVEY

On February 19th an important conference on *Work Study in Farm, Field and Factory* was held in London. Mr. Harvey, who specialized in agricultural work study when attending Purdue University, Indiana, as a Kellogg Fellow, summarizes the proceedings of this conference.

UNDER modern conditions, the success of the farming industry depends largely on a steady supply of materials, equipment and skills from the economic cosmos that lies beyond the farm gate, and the success of the individual farm business depends largely on good management. Both these facts of contemporary agricultural life were reflected in the character and purpose of the Work Study Conference sponsored by the British Institute of Management, the Association of Agriculture and the Institution of British Agricultural Engineers.

MR. MAUDLING, the Paymaster-General, sketched the background of our times and showed the clear need for increased productivity if we are to maintain our standard of living and fulfil our international commitments. He was followed by MR. R. M. CURRIE, head of the Central Work Study Department of I.C.I., who continued the Minister's theme and showed the part that work study could play, indeed was playing, in meeting the needs of our competitive times. Nobody who heard Mr. Currie will again accept any of those shoddy little clichés which so often pass as descriptions of work study.

The third speaker was MR. GORDON LUGG, who is head of the I.C.I. Agricultural Work Study Unit. He carried the argument into the literal field of farm management, detailing the procedures used in applying work study on the farm and quoting instances of the results achieved. Finally, MR. HUGH FINN consolidated matters by giving his experiences as a consumer of work study, describing, in practical terms of money and man-hours, the savings which Mr. Lugg had secured on his farm.

The questions were vigorous and prolonged. They showed both the interest of the audience and the consistency of work study doctrine, for the panel, who were trained in different schools, belonged to different institutions and applied work study under different circumstances, returned interchangeable answers. They made it clear that work study is no convenient name for a vague, fluctuating collection of bright ideas about ways of increasing efficiency. It is a precise term for a precise discipline, and for a set of recognized procedures and techniques for improving ways of doing work. And the implications of this are important. Common sense, attitudes of mind and

good intentions do not of themselves make the work study man. Like any other discipline, work study must be learnt before it can be properly applied. It is not a job for enthusiastic amateurs.

A specialized job

Thus proper work study is a fairly specialized kind of job. It is also a time-consuming one; for method study, which is at present the only section of it ready for immediate agricultural use, requires days rather than hours for each individual case. All this makes it too expensive to apply in a haphazard manner wherever somebody thinks it would be a good idea. It should only be applied where it will pay.

But how do we know where it will pay? The answer is—by economic analysis. In the classic phrase, "work study is a tool of management", a means whereby management can analyse and remedy weaknesses in the physical running of a business. Management, therefore, decides which enterprises, or parts of enterprises, are likely to return reasonable dividends for an investment of work study resources. In less general terms, the farmer asks the agricultural economist to prepare an analysis of the farm business as a whole, and identify from it those sections which will probably justify the application of work study.

So the work study man receives his terms of reference from the farmer through the economist, who thus becomes his first ally. But he needs other allies as well. Above all, he needs the co-operation of the farm workers, without which he should not even attempt to start. Experience suggests, however, that it will be given cheerfully, provided the work study man explains what he is going to do and why he is going to do it. After all, this is where his subject began, for Taylor and Gilbreth, the two great pioneers of work study, both spent some years of their early lives as manual labourers, and both originally developed their techniques to meet the needs of their daily work.

Further, as the work study man proceeds with his investigations, he will find himself requiring information which his particular discipline cannot provide. He will want to know why certain jobs are done in certain ways, what would happen if they were not done at all, and whether they could be done in other ways. These are technical questions, to be answered by the farmer himself or by outside technical advisers. Thus the work study man is essentially a member of a team; he cannot do his job in isolation. And when he has finished his study, he returns to where he started—to management. He may suggest and advise; but the farmer—the manager—makes the decisions.

Not a panacea

Properly applied, work study is a very valuable means of tackling one of the major farm problems of our time. But it is no panacea, no *deus ex industria* to set all things right. Indeed, its immediate scope is limited by its own weaknesses of development. Firstly, in a rural economy where half the cost of running a farm goes on labour and machinery, the potential harvest for work study is more than plentiful. But work study specialists are very, very few. Even when the three-month work study course for fifteen agricul-

turists now being run by I.C.I. is complete, the number of qualified men in our industry will be counted at most in dozens. Secondly, very little progress has so far been made with work measurement which, in crude analogy, is the means whereby work study can be applied wholesale, as compared with method study, which is the means whereby it can be applied retail. And even when work measurement data become available, some understanding of work study will be necessary for their proper application.

These things were made clear from the platform. But they did not reduce the enthusiasm of the audience. On the contrary, they may well have encouraged the motion from the floor that the Ministries of Agriculture and Education and the National Farmers' Union should be urged to consider ways of developing agricultural work study and of making it more readily available to farmers. This was carried with a few abstentions but no opposition. For it is certainly true that, on technical grounds alone, work study cannot be properly developed and applied in any industry without a concerted effort by all those concerned with that industry's management and operation.

Variety Trials with Dutch Threshed Peas

J. D. REYNOLDS, N.D.A., C.D.A.(HONS.)

Pea Research Station, Yaxley, Peterborough

Trials have been conducted to see how some new varieties of Dutch peas for harvesting dry perform under English conditions.

WITH the ending of the Second World War, quantities of several new Dutch blue pea varieties were imported by packeting and processed-pea canning firms, initially for reproduction. By this time the Dutch marrowfat Zelka had largely replaced its English ancestor, Harrison's Glory, although growers and the trade continued to use the English name as a synonym for Zelka, because of the close similarity of the two varieties.

These developments, and the dearth of performance data for other Dutch threshed peas under British conditions, led to the holding of replicated yield trials from 1949 to 1952 inclusive, the detailed results of which have recently been reported.[1] The trials were carried out jointly by the Home Grown Threshed Peas Joint Committee (now replaced by the Pea Growing Research Organisation Ltd.) and the National Institute of Agricultural Botany, with the co-operation of the National Agricultural Advisory Service; trials conducted at the Terrington Experimental Husbandry Farm have been described elsewhere.[2]

Varieties compared

Some details of the varieties tested are given in Table 1, while their origins and inter-relationships are set out in the figure on page 37, constructed from diagrams published in Holland.[3]

Emigrant, brought into commercial use in 1952—twenty years after

Zelka—was of interest because it was claimed to give higher yields on poorer soils, and produced seed which was greener and less inclined to fade. Mansholt's G.E.K. and Unica, well-established blue varieties, were gradually being ousted by Servo, Rondo and Stijfstro, introduced in Holland between 1943 and 1946. Dutch experience had shown Servo and Rondo to give particularly high yields, while Stijfstro, as its name suggests, was notable for its strength of straw. Another important character possessed by Rondo and Stijfstro, as distinct from the other blues, was resistance to the disorder originally known as *Fusarium solani* (foot rot) but now attributed primarily to the aphid-transmitted virus disease called top yellows, which is particularly troublesome in Holland.

Table 1

The varieties tested

Marrowfat, with large-sized indented seeds	*Breeder*
Zelka	Ir. C. Koopman, Hoofddorp
Emigrant	Dr. R. J. Mansholt, Westpolder (Gr.)
Blue, with medium-sized smooth round seeds	
Mansholt's G.E.K.	" " " "
Unica	Mr. P. J. Hijlkema, Mensingeweer
Servo	" " " "
Rondo	Centraal Bureau, Rotterdam
Stijfstro	" " "

Field observations

Trials covered a wide range of soil types in the eastern counties, from Holderness in East Yorkshire southwards to the Romney Marsh in Kent. Ordinary corn drills were used for sowing, most trials being sown in 7–8-inch rows, using a seed rate of about 15 stones per acre. As far as possible seed once-grown in this country and from the same source was used for all trials in each year. Fertilizer treatment, cultivations and harvesting were as for commercial crops.

Emigrant and Servo were the most vigorous in growth, the latter being a particularly good ground coverer. By contrast Stijfstro lacked vigour, its foliage—like that of Unica—tending to be pale or even yellow; this was possibly due to drought susceptibility on account of sparse foliage (Stijfstro) and short straw (Unica).

There were small differences between varieties in date of commencement of flowering. Emigrant was earliest, followed closely by Zelka; Stijfstro was latest. In spite of beginning to flower first, Emigrant and Zelka tended to mature last. Unica was the earliest and Stijfstro the latest of the blues to ripen. Only a few days, however, separated the first and last varieties.

Stijfstro invariably proved resistant to lodging, whilst at the other extreme Mansholt's G.E.K. very often became laid following pod-setting. No variety was consistently susceptible to shedding at harvest.

Average straw lengths at maturity were:

	inches		*inches*
Emigrant	28	Servo	20
Zelka	23	Rondo	19
Mansholt's G.E.K.	20	Stijfstro	19
		Unica	18

Dutch results confirmed

Table 2 shows the mean yields (corrected to 16 per cent moisture) of the varieties, in descending order, over all four years (39 trials). Best results were given by Servo, which significantly outyielded all other varieties except Rondo.

Table 2

Average yields

Variety	*cwt per acre*	*per cent of Servo*
Servo	25·3	100
Rondo	24·1	95
Unica	23·4	92
Emigrant	23·1	91
Stijfstro	23·0	91
Mansholt's G.E.K.	22·5	89
Zelka	21·5	85

There were significant interactions between varieties and sites in all years. That the average annual results were nevertheless consistent from year to year, however, indicates that variations in weather conditions were not alone responsible. Grouping the results according to soil type and yield showed that the yielding order remained virtually unchanged, although differences were greater where yield was high. This accounts for part of the interactions, and other variables—for example, seed rate, row width, disease and pest damage, etc.—probably explain the remainder. The findings both in regard to field characters and yielding capacity accord with Dutch experience.[4]

Promising varieties

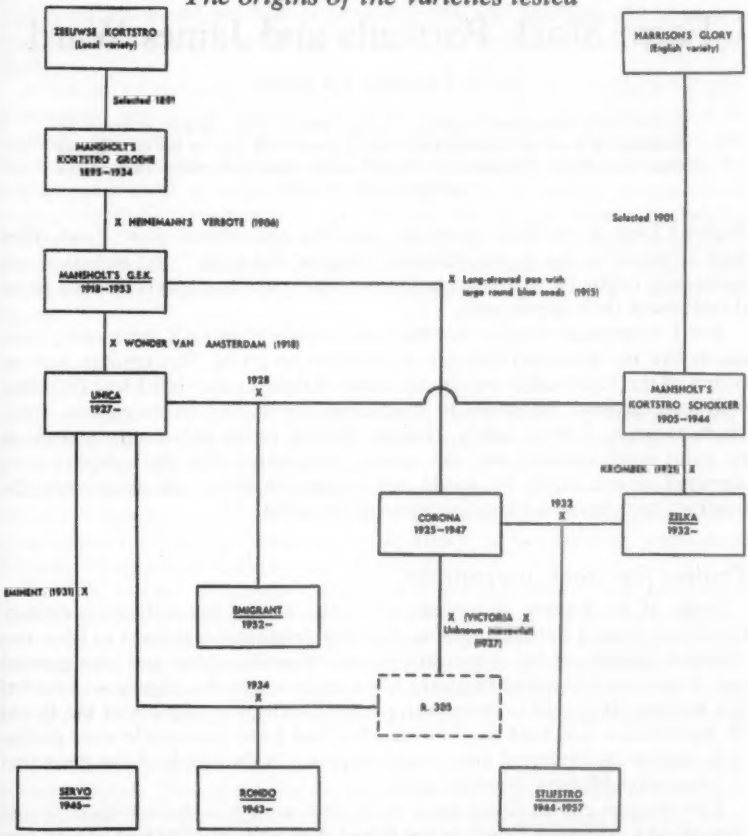
Marrowfats are preferred by the trade for packeting and particularly for canning as processed peas, and therefore command a higher price than blues. However, the choice of such varieties as Servo and Rondo in place of Zelka is worth consideration on land of above-average fertility, where the extra yield may well be large enough to offset the lower price per cwt. The shorter straw would also be advantageous.

Texture tests carried out over three years by the Fruit and Vegetable Canning and Quick Freezing Research Association on the produce of a number of the trials showed that all the blue varieties were suitable for canning as processed peas.[5] There were only slight differences in texture between them, but all were more tender than Zelka and Emigrant.

Of the marrowfats, Emigrant yielded more than Zelka, this and its longer straw marking it out as a possible successor to Zelka on soils of below-average fertility. The experience of the trade, however, has been that its seed shape is not uniform enough, and for this reason the variety has not become popular; Zelka therefore remains the first choice in the Dutch marrowfat group until sufficient information is available on the performance of even more recent introductions.

The writer acknowledges the co-operation of the farmers concerned, and the assistance of the N.A.A.S. officers who supervised many of the trials. He is also indebted to Mr. E. G. Thompson and Mr. C. G. Finch of the Trials Branch, N.I.A.B., in connection with planning and Statistical analyses, and to Mr. M. H. Westmacott, Statistics Department, Rothamsted Experimental Station for advice on the interpretation of results.

The origins of the varieties tested



The years given in the boxes are the date of commercial introduction in Holland and, where applicable, the date the variety was removed from the Dutch *Descriptive List of Varieties of Field Crops.*

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Farm Stock Portraits and James Ward

G. E. FUSSELL, F.R.HIST.S.

In the early nineteenth century, James Ward, R.A., began a series of paintings to portray faithfully the cattle, sheep and pigs of his day. It was never completed, but much of Ward's work remains to show us how the animals really looked.

WHEN I look at our farm stock at a modern agricultural show, I am filled with admiration, and it is comforting to know that their "vital statistics" are accurately captured by photography, so that our descendants will be in no doubt about their appearance.

But I sometimes wonder whether our ancestors' animals were really very much like the paintings that are all we have to go by. The owners were so proud of the fashionable weight and bulk of their beasts that I feel they may well have pressed the artists to concentrate upon, and so exaggerate, these characteristics. Indeed, when Thomas Bewick rather reluctantly undertook to paint some animals and the owner complained that the subjects were depicted as too slight, he would not exaggerate them and abandoned the contract, perhaps to a more accommodating artist.

Project for stock portraiture

Some of the leaders of agriculture at the end of the eighteenth century must have shared Bewick's doubts, for they originated a scheme to have two hundred pictures of the significant breads of cattle, sheep and pigs painted and drawn to exact scale. Precisely when or by whom the scheme was started is a mystery. It is said to have been planned under the auspices of the Board of Agriculture, and both Sir John Sinclair and Lord Somerville were parties to it, but the management and finance were put in the hands of the great firm of pictorial publishers, Boydell and Co.

The obvious choice of an artist to do this work was James Ward, whose picture "An Alderney Cow" in the Royal Academy of 1799 had gained him the title of the English Paul Potter. This picture may have been painted for Sir John Sinclair or it may have been part of the Board of Agriculture-Boydell scheme. Earlier Academy exhibits, "A Staffordshire Bull" and "A Staffordshire Cow" (1797) were respectively portraits of "Bright", a Longhorn belonging to Thomas Princep of Croxhall, and one of his cows. Pictures of these animals, not Ward's, adorn William Pitt's *General View of the Agriculture of Stafford* (1795). For the similar report on Kent by John Boyes which appeared in the same year, Ward engraved a small Southdown ram belonging to the author.

Though he had painted a good many other pictures of rustic scenes, by 1800 Ward was extremely well known as an animal painter. His reputation, combined with his acquaintance with both Presidents of the Board of Agriculture, could not be equalled. A contract was arranged with Boydell's, but not I think in writing, the firm agreeing to pay fifteen guineas for each subject, and to supply funds for Ward's expenses in travelling to see the

animals he had to paint. Ward expected to deliver one picture a week and that Boydell's would pay him at once. But this was not Boydell's idea; the firm intended to pay after the publication of engravings, and set no time limit.

A list of subjects was drawn up by Lord Somerville, assisted by Mr. Lawrenson, and Ward began the work in 1801. At first he tried to do it in London. He went to Plaistow and elsewhere, seeking prize cattle that butchers had bought for slaughter. When the animals were discovered, he had to paint them at night by the guttering light of torches, because they were going to be slaughtered in the morning. He spent at least three weeks in this way. It was very different from being an honoured guest at a great landowner's house, painting portraits of his horses and cattle at leisure and in comfort, and the bad light made the work difficult. Ward resented the change.

Journey by gig

During 1801 he was much occupied with cattle portraits. Boydell's supplied him with a secondhand gig for which Ward was duly charged the £27 it cost. The rough usage of continual travel over poor roads and unmade tracks into the remote countryside would have been a severe strain on a new vehicle: it was too much for an old one. He spent a lot of money on occasional repairs, but had to abandon it in Anglesey in the following year, when it finally collapsed. It fetched only 3½ guineas.

The first journey Ward made was a visit to John Ellman of Glynde, the famous breeder of Southdown sheep. Ellman also bred the beautiful Sussex red cattle, and won prizes with them. Lord Somerville was a friend of his, and that was a good reason why Ward should be sent to paint examples of his cattle and sheep. Ward's next journey was to Windsor Castle to paint two of the King's sheep; this must have gratified him and made him a proud man.

These two short journeys over, Ward set out on a tour of the south-west, through Dorset, Devon, Cornwall, Somerset, Wilts and Berks. It took two months, and he made many drawings of local livestock, including at least four Devon cattle. These may have been the originals of the engravings that illustrate Charles Vancouver's *General View of the Agriculture of Devon* (1808), another of the Board's surveys. Ward also painted an Isle of Portland sheep, which was a smaller and more agile variety of the Dorset; a Southdown ewe; a Devonshire hog; and a Berkshire boar, hog, pig and sow separately. Perhaps he painted other animals during this time, but the titles of some pictures do not show the source of his models.

On his return Ward visited his friend and patron, Francis, fifth Duke of Bedford, though he felt a grievance because he painted only one sheep at Woburn. This was the last journey he made that year for the Board of Agriculture-Boydell business. Seven months of 1802 were occupied with it. He went through Gloucester to Wales, from Glamorgan through mid- and coastal Wales to Pembroke and Anglesey, and back home through Salop and Hereford. No wonder the gig broke down.

During this journey Ward displayed indefatigable industry. He made hundreds of animal studies and numerous sketches of scenes and people he

met. One of his biographers put the number at 581. He painted the famous "Fighting Bulls at St. Donat's Castle" then.

The quarrel

Ward did some travelling on this account in 1803, though there are no details among his surviving papers except a note that a journey to Ashbourn, Derbyshire, cost him £11 8*s.* 0*d.* His relations with Boydell's continued to be unsatisfactory and broke out into a serious quarrel in 1805. He had painted many more pictures than the firm either could take or wished to publish, and he had also painted many scenes and events that were outside his contract—two prominent points of dispute.

The painter maintained that Alderman Boydell had agreed to publish the pictures as quickly as he made them: Boydell, that he was entitled to issue them as and when he pleased. Since Ward was paid on publication, Boydell's contention touched him very closely. Again, Lord Somerville had scrutinized the pictures and reduced the number chosen for publication, much to Ward's annoyance and financial loss.

Ward presented Boydell's with an account in 1805, accompanied by a fierce denunciation of the firm's methods and a stern demand for more money. The account is not easy to understand, but he claimed to have produced a hundred and fifty pictures besides those painted and sent home. He demanded a payment of £20 a week for the time spent in travelling, and expenses at the rate of one guinea a day. This was certainly not definitely stated when the work was arranged. Boydell firmly refused, declaring that he had already paid more than the agreed value of the pictures sent in.

The end of this enterprise is befogged; many letters were exchanged but no perceptible conclusion was reached. James Ward had travelled through a great part of the United Kingdom and painted more than two hundred portraits of animals, but he wrote sadly in the last year of his life that the King, the patron and the publishers died and the Society (the Board of Agriculture) sank, leaving him a loser by many hundred pounds. These melancholy events did not all happen at once as his note suggests, but at intervals during the two decades after 1810. Whether the job just petered out or whether Ward ceased to do anything further is not clear. The brave plan of making a permanent record, in realistic paintings drawn to scale, of our breeds of livestock as they were about 1800 ended in disappointment, annoyance and trouble, but many of Ward's pictures remain. They at least can be accepted as depicting our livestock as they really were.

Farming Cameo: Series 2

1. South Bedfordshire

OLIVER J. DENYER, B.SC., N.D.A.
District Advisory Officer

The first "Farming Cameo" series was published in this *Journal* from October 1950 to March 1955. This second series will similarly attempt to sketch the farming enterprise of selected small areas in England and Wales, with reference to their physical and economic circumstances.

IN contrast with the north of the county and its relatively uniform soils and agriculture, the south is a district with a diversity of features, soils and farming. South of Bedford the flat, low-lying area of Oxford Clay, Bunyan's "Slough of Despond", dotted with the tall sulphurous chimneys of the brickworks, gives way to the distinctive sharp face of the greensand ridge. From this ridge, varying between 400 and 450 feet above sea level, across the valley formed by the gault, can be seen the steep scarp face of the chalk hills, the most prominent feature in the county. Between Dunstable and Whipsnade, the Chilterns rise to over 800 feet, the highest point in the county and indeed in the Eastern Region.

This geological division to some extent governs the type of farming, though the low annual rainfall—23–24 inches—ensures that cereals play an important part in farming economy over the whole area. The greensand ridge, running N.E.-S.W. across the county, roughly from Sandy to Leighton Buzzard, has on its eastern half, where it widens out, the well-known market gardening area. Growing rapidly with the coming of the railway a century ago, this area of early, light loam situated conveniently for the large markets of London and the industrial Midlands, is now one of the most highly organized market gardens in the country and warrants separate attention.

West of Ampthill, along the ridge where the sand comes to the surface and the soil is of little agricultural value, a large area is under forestry. Some of this is in the hands of the Forestry Commission, but rather more is private planting on the Duke of Bedford's estate. Much new planting has taken place in the last twenty to thirty years, most of it Scots pine which starts producing, in the form of Christmas trees, relatively quickly. As fresh uses are found for this wood, thinning, clearing and replanting go on continually.

Away from the ridge the soils become very mixed, with clay drifts, gravels, etc., of glacial origin. These soils are generally fertile, although variable from field to field, and within fields. The farming is very mixed, the smaller farms having a high proportion of leys and carrying dairy herds. On the larger farms there is generally beef rearing and fattening, and small sheep flocks. The 3–4 year ley is the basis for fertility and alternates with cereals, potatoes and brassicas for market.

The gault, running in a comparatively thin strip between greensand and chalk, covered here and there with glacial drifts, tends to lie wet and is difficult to work, but with drainage and heavy equipment it can be very

productive. This area is farmed with the minimum of livestock, fertility being maintained with one-year leys (often for seed), peas, beans and fallows. This is the best wheat land in the district, and yields of 2 tons per acre are common.

To most people, South Bedfordshire implies the Chiltern Hills. In fact, the abode of the "Uncrowned King of the Chiltern Hills" is only just over the border at Ivinghoe. Dunstable Downs, Whipsnade and the Barton Hills are all very familiar to suburban dwellers north of London, as evidenced by the crowds at weekends during the summer. Along the steep face of the Downs there is little soil; and with slopes too difficult for cultivation, the natural vegetation is mainly sheep fescue, agrostis, and thorn bushes. Up to thirty years ago these slopes supported large numbers of sheep, but since the disappearance of sheep during the Second World War, no real effort has been made to reintroduce them; dogs and ramblers from the ever-growing towns of Luton and Dunstable make life intolerable for the sheep farmer. In one or two places remote from the towns several areas have recently been cleared and fenced and are now carrying sheep once more.

Southwards from the scarp, the land dips gently undulating, giving rise to a belt of chalky loam, up to 18 inches deep—the fertile Icknield loam. In this area, farms tend to be large, mainly arable and highly mechanized. Cereal production predominates, the rotation being broken with potatoes, clovers for seed, and of recent years, sprouts. Useful malting barleys are grown, and in this area there is still an appreciable acreage of Earl and Plumage Archer. These, and Pioneer, are frequently winter sown, to get an early start and to spread the harvest.

South of Luton and Dunstable, the chalk is capped with a "clay with flints" deposit of varying depth. Intrinsically very acid, the very heavy dressings of 40–60 tons per acre of chalk (obtained by digging pits through the clay in the fields to be chalked) which were applied up to forty years ago, continue to keep the soil in good condition. This area is farmed variously with short-term clover leys breaking up a mainly cereal rotation, or longer leys which are utilized about equally for milk or beef production.

Farming in South Bedfordshire has to be highly competitive with industry for labour. The large, and growing, light engineering industries of Luton and Dunstable, the brick-works to the north, lime and cement workings on the chalk, and the extensive building sand workings around Leighton Buzzard, draw their highly paid labour from villages throughout the district. To the farmer, labour is a scarce and costly commodity. In the arable areas, this has been countered by a high degree of mechanization, employing on average about one man per 100 acres. For the dairy farmer, the degree of mechanization to save labour is limited, and there is no easy answer. Recently there has been a move towards the yard-and-parlour system for milking, and the Silo Subsidy and Farm Improvement Schemes have stimulated interest in feeding lay-outs more economical of labour. Self-feed silage is very much in most dairy farmers' minds at the moment.

Agricultural interest in this District lies in its variable nature, with arable farming typical of the eastern counties, beef and sheep fattening akin to the neighbouring Midlands, and dairy farming like that further south. The whole is leavened with market garden crops. Overall, the standard of farming is high as befits farming in an area of highly efficient light and heavy industry.

Farming Affairs

The landlord's consent to farm improvements

Although the buildings and other "fixed equipment" on a farm are rightly regarded as a landlord's responsibility, there are many cases where improvements can be profitably and usefully carried out by tenants. Indeed a tenant has an equal right with his landlord to apply for a grant under the Farm Improvement Scheme, though he must produce evidence of his landlord's consent. This is because the Scheme is intended for the long-term benefit of agricultural land, and unless the landlord's consent is given there can be no assurance that the improvement will not be removed on the departure of the existing tenant.

The law on the matter is simple and fair. If a tenant makes a long-term improvement without consent he forfeits all right to compensation for it on quitting. If he asks for, and obtains, his landlord's unconditional consent (which must be given in writing) he receives the statutory compensation when he leaves, which is the amount by which the improvement has increased the value of the farm—valued at the date of quitting. There is nothing to stop a landlord and tenant agreeing to special conditions, and by this means a different method of compensation can be substituted for the statutory one. If a landlord refuses consent, however, or tries to impose conditions that the tenant considers unreasonable, the tenant may apply for "the Minister's" consent to the County Agricultural Executive Committee (the Agricultural Land Tribunal in future), at which the owner can say why he refused. If the application is considered reasonable and in accordance with good estate management, then "the Minister's" consent is given, and overrules the owner's refusal. But the tenant has to wait at least a month before he can start the job, to give the owner time to decide if he wants to do the work himself.

The popular idea of a landlord is of a man who owns vast estates and has ample resources. But pilot surveys have shown that the true picture is very different, and that as many farms are rented from "single-farm" owners as from the larger estates. Such small owners seldom have other resources from which to finance improvements, and the sensible ones, possessing a good tenant, will welcome suggestions for keeping their farms up-to-date by improvements done at that tenant's expense. If they are wise they will make sure that what the tenant wants to do is for the long-term benefit of the farm, and that the job is well designed and properly carried out.

Even so, many owners hesitate to give consent to work which would without doubt improve their farms and their financial interest in them in the future. Usually the reason is that they fear having to pay compensation which they can ill afford, with the further uncertainty as to the amount or the time of payment. To surmount this difficulty it is nearly always a good idea to settle the terms of compensation in advance, at the time of giving consent. This is usually done on a simple depreciation basis of the net cost to the tenant (after deducting grants and special tax concessions), the term of years depending on the nature of the work—for example, 12 or 15 years for elec-

trical work, or 25–30 years for a new or modernized permanent building. If the tenancy survives the depreciation period, the tenant has had full value from his expenditure and the owner has nothing to pay. But if the tenancy ends earlier, and the owner cannot afford to pay the written-down value at that time, it is always open to him to make his new tenant take over the liability, with similar conditions as to compensation.

Most disputes arise either because the owner is unreasonably obstructive or not co-operative, or because the tenant wants to make a quite unsuitable improvement—unsuitable, that is, when considered as "fixed equipment" which will eventually belong to the owner. In either case an application by the tenant for "the Minister's" consent will take the matter to independent and experienced people for decision, and is the obvious and sensible thing. So much so that an owner with a difficult tenant can lose nothing by pressing him to seek "the Minister's" consent, and if the landlord is difficult, the tenant will need no pressing.

H. E. G. Read

At the Farmers' Club

INDUSTRIAL RELATIONS IN AGRICULTURE

The tremendous changes which have taken place in agriculture in the past decade have occurred with practically no industrial unrest. There has been no major dispute for 35 years.

Addressing the Farmers' Club in London on 12 March, Harold Collison, General Secretary of the National Union of Agricultural Workers, attributed this largely to the innate closeness of the relationship between employer and employee, and to the willingness of the work-people to learn new techniques and adapt themselves to new methods. But in the absence of any conscious positive industrial relations efforts on the part of the farming industry, or of any organized attempt to equip the workers technically, this situation should not be expected to continue indefinitely. "Particularly is this true where management is introducing still further productivity drives, including the use of work and method studies." These techniques, imported from industry, will only be successfully applied if both sides strive for mutual trust, understanding and full consultation right from the start.

The tied cottage remains almost as big a problem today as it was 50 years ago. Farmers wish to retain the system and the workers are opposed to it. "Many farmers would probably be in favour of a change in the law if they realized that all the worker requires is protection from eviction, not indefinitely, but simply until suitable alternative accommodation can be found." Meanwhile, with over 40 per cent of farm workers living in tied cottages, the system is a barrier to good relations, which flourish best when both sides are completely free to negotiate as equals.

The farm workers' attempts to organize to obtain better conditions were fraught with bitterness, strife, lock-outs and strikes, from the days of the Tolpuddle Martyrs in 1834 to the last major strike in Norfolk in 1923, when some 10,000 men were involved in a dispute lasting several weeks. This strike stopped the fall in wages that had gone on since 1921, when wage fixing was scrapped by the Government of the day. In 1924, wage fixing was re-established, but only on a county basis: the national minimum wage did not come until 1940.

Today, wages and working conditions decided upon by the Agricultural Wages Board are enforceable by law. As the decisions of the Board depend on a majority vote, on the frequent occasions when the 8 workers and 8 employers on it have been opposed, the decision has rested with the 5 independent members. In recent years, they have always voted all one way or another. Mr. Collison considered this to be one of the great weaknesses of industrial relations in agriculture—"it should have been possible to have reached a negotiated settlement on many more occasions than has been the case in the past 10 years". The constitution of the Board was at fault: if the independent members were drawn in equal numbers from either side of farming—at present they are not—both sides would have the satisfaction of knowing that decisions stemmed from people understanding their own point of view.

Mr. Collison explained that whilst appreciating the reasons why farmers have been suggesting an annual wage review recently, workers must reserve the right to seek adjustment when circumstances demand, for "it is unrealistic to expect them to accept a standstill on wages for 12 months, regardless of what may happen to their standard of living in the meantime".

In farming, employer and employee develop mutual understanding and respect from working in close co-operation, often side by side. Any improvement in their relationship will further the prosperity of the farming industry and all engaged in it.

Sylvia Laverton

Children and farm accidents

As from 1 July this year, children under the age of 13 become the subject of regulations designed to safeguard them from injury on farms. Broadly these regulations provide that children must not drive, or ride on, tractors or self-propelled machines (or drive self-propelled vehicles), in use for agricultural work, or on their way to and from work. Nor must they ride on machines mounted on, or moved by, tractors or vehicles; and, in the case of binders and mowers this prohibition applies even where they are drawn by animals. Children may ride on the floor of a mechanically-drawn trailer, and they may ride on the load, but only if the trailer has four sides all higher than the load. They must not ride on any trailer with a built-in conveyor mechanism. The regulations do not prohibit children from riding on a horse-drawn vehicle such as a haycart or wagon. Nor may children be allowed to ride on agricultural implements mounted on or moved by tractors or vehicles, nor to ride on rollers (even when they are drawn by animals), drawbars, etc., including those of mechanically-drawn trailers.

Anyone who permits a child to disobey the regulations is guilty of an offence under the Act, and the maximum penalty is £50.

A free leaflet explaining the regulations is available from the Ministry (Publications), 23 Soho Square, London, W.1.

In Brief

MALTING BARLEY

Scientifically, the top dressing of malting barley is a desperate gamble, for although the nitrogen content is a hereditary characteristic of malting barley, it is also influenced strongly by season and management. Dr. G. D. H. Bell, Director of the Plant Breeding Institute at Cambridge, told a recent gathering of farmers, maltsters and brewers in Ipswich that early top dressings could increase grain yields without increasing N percentage only if the nitrogen fertilizer acted immediately; a spring drought would inevitably result in lower grain yields with a higher N percentage. Fertilizers applied in the seedbed have the greatest chance of putting up high yields with an N content acceptable for malting. Even high-tillering varieties cannot overcome the adverse effect of late-acting nitrogen fertilizer. The pattern of yield is laid down by the fertility of the soil and the fertilizer used in the seedbed.

Mr. J. R. Heron, a brewing consultant, explained that when high-nitrogen barley is converted to malt, a relatively large proportion of its complex protein content resists breakdown and persists through subsequent brewing operations, making the beer cloudy. The flavour, head, body and brilliance of pale ale all depend on the nitrogen content of the original barley.

STORAGE LIFE OF COX'S ORANGE PIPPINS

The effects of orchard conditions and storage methods on the life of commercially-grown Cox's Orange Pippin apples have been under investigation since 1954 in experiments in which growers and fruit research stations are collaborating. Last season's test apples were displayed and discussed at the East Malling Research Station on 27 February.

Once again, Cox's from a wide range of growing conditions kept longer in gas than in cold store without any increase in *Gloeosporium* rot. As in previous years, fruit from trees under ten years old had much less rot than fruit from older trees, and there were more rots in fruit from light soils. The experiment includes a comparison of the keeping quality of fruit from trees given high and low levels of nitrogen fertilizer, and the results indicate that low nitrogen is preferable both for gas and cold storage. Every year since 1956 captan, where used in spring to control scab, has given a greater proportion of good samples, after storage, than where a sulphur spraying programme has been used. There seems to be a possibility that with gas storage and improved methods of controlling *Gloeosporium* it may soon be practicable to store Cox's until March or April.

NEW LABS FOR OLD

New laboratories, covering an area of 11,000 sq. feet, have been built at the Yalding works of Plant Protection Ltd. They have been designed to replace the original buildings which have been in service for the past twenty-five years, and their main function will be to prepare and test the increasing number of crop protection chemical formulations that have nowadays to stand up to a widening variety of climatic and other conditions. Allied work will concentrate on control and quality of the chemicals and the determination of possible toxic residues on crops in this country and overseas to ensure safety to the consumer.

IN BRIEF

GOOD FARMING AND GOOD LOOKS

"We say our farming forebears were the landscape gardeners of England; that the beauty of our countryside is man-made. So it is. But when you analyse the pattern of hedgerow and dry wall, and the siting and construction of farmsteads that look as though they grew there, you find they are where they are, and as they are, because they were the answers to practical problems. They fulfilled their function as perfectly as the old plough handle fitted a ploughman's hand.

"Now we farm in an age of transition. Over the next ten years or so, many millions of pounds will be invested in fixed equipment, and here is our opportunity and our responsibility. We no longer build for our grandsons, whose ideas and needs may make ours look prehistoric; nor have we the cheap labour and materials of our forebears. And here is the problem that architect and farmer must solve, and solve it without obliterating our sound regional traditions of materials and design by mass-produced materials and cliché-ridden ideas that look the same in Kent and Cumberland."

So writes Mr. W. L. Thomas in the March issue of the *British Farmer*. The agricultural Research Fellowship in farm building design, worth £1,800 and endowed by the N.F.U., has been awarded to Mr. John Brian Weller, a 27-year-old architect from Wolverhampton. The emphasis in modern farm building design, Mr. Weller said, must be on flexibility. He subscribes to no preconceived ideas and he looks to developments with local materials that will help to retain the best of local and regional traditions. There is no reason why low costs should mean low tastes.

PRE-WILTING FOR SILAGE

Pre-wilting of herbage for silage-making was advocated by Dr. J. C. Murdoch of the National Institute for Research in Dairying at BOCM'S Writtle Conference on 6 March. He explained that by pre-wilting he meant raising the dry matter content to about 30 per cent—say, drying for 4-6 hours on a good spring day, but, of course, the time must be modified by weather conditions and the yield of the crop. Wilted silage can be made when it would be risky to start making hay.

A silage is normally well-fermented when dry herbage is used, and this applies to lucerne (probably the most difficult of crops to make into silage) as well as young, lush grass. There is little or no seepage from the silage, when the dry matter content of the herbage ensiled is over 25 per cent and so no loss of valuable nutrients. Another point which Dr. Murdoch made was that the drier the silage, the higher the dry matter intake of the animal. Silage is a bulky and succulent food, and therefore it is often difficult to get an animal to eat enough of it to satisfy its nutrient requirement.

But a careful watch must be kept on the temperature of wilted silage; it is more difficult to consolidate than freshly cut herbage. The silo must be filled fairly quickly and the silage heavily consolidated, otherwise an overheated silage will result. If the herbage is chopped or lacerated, consolidation will be very much easier. Mature, stemmy herbage should at most be only slightly wilted. Another precaution well worth taking is to finish off the silo with freshly cut material. This will help to eliminate some of the overheating that might occur in the top layers.

THE FARMING INDUSTRY

Britain's agricultural industry employs about 1 million people or 4·3 per cent of those in civil employment; it provides 4·5 per cent of the gross national product, and uses 48 million of the 60 million acres of land.

Britain: Official Handbook

Short Guide to the Annual Review, 1958

THE Annual Review and Determination of Guarantees for this year were published in the White Paper (Cmnd. 390) on March 20.*

Agricultural output is estimated to have risen from 61 per cent above pre-war in 1956-57 to 63 per cent above pre-war in 1957-58, largely as a result of a further rise in the output of livestock products. Beef, mutton and lamb production has continued to expand and there is a continuing upward trend in the output of milk and eggs. The production of pigmeat shows a new and sharp upward trend. The arable area was substantially maintained, a decline in the acreage of tillage crops being offset by an increase in temporary grass.

The actual net income for 1957-58 is forecast at £360 million, compared with £314 million for 1956-57. This is by far the highest ever recorded. The total cost of agricultural support has risen from £206 million in 1955-56 to £240 million in 1956-57 and to an estimated £290 million in 1957-58.

The main objective continues to be that production should be more economic, which means striving for a steady improvement in the competitive position of the industry. This will depend on securing decisive reductions in unit cost, including the elimination of some of the highest cost production, by adopting improved techniques and better farm management. Greater adaptation of what is being produced to the needs of the market is also important. The industry will not secure these results merely by a general increase in production; markets are already amply supplied and the reduced outlets for further supplies have become more selective.

The industry, by its efforts, has made a substantial contribution to the balance of payments. But the recent expansion of gross output has been based largely on the production of milk, pigs and eggs, at a substantial cost in imported feed, and the value to the balance of payments of such output is doubtful.

The Government's view is that, on present prospects, no further expansion in gross output, particularly of milk, pigs and eggs, is required. What is needed is the selective maintenance or expansion of net output at the lowest possible cost per unit, and in the Government's view this should be sought in the following general directions:

1. The maintenance of a large arable acreage of something like the current size but with more emphasis on feed crops rather than wheat.
2. Greater reliance on home-produced feed for livestock.
3. Production of more beef and lamb of the quality wanted by the market.
4. The production of less milk, pigmeat, and eggs.

The total value of the guarantees to farmers has been reduced by £19 million, to a figure £2 million above the minimum assured by the Agriculture Act, 1957.

As regards the special problem which arises because many small farmers are particularly concerned with the production of milk, pigs and eggs, the Government intend to initiate discussions not only about the revision of the Marginal Production Schemes but also about proposals they are preparing for additional provisions to give further assistance to the small full-time farmer. Meanwhile, because of the importance of the guaranteed price for milk in the economy of many small farms, the necessary reduction has been limited to 1*d.* a gallon.

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* H.M. Stationery Office, price 1*s.* (1*s.* 2*d.* by post).

Guaranteed Prices

Note: For the bases of the prices given below and other particulars of the guarantee arrangements, see the Additional Details of Guarantees in Part II of Appendix V of the White Paper (Cmnd. 390).

Livestock and Livestock Products

Commodity	Guaranteed Prices 1957–58 as determined after the Annual Review, 1957	Price change compared with the 1957 Annual Review guarantee	Guaranteed Prices 1958–59 as determined after the Annual Review, 1958
Fat cattle (per live cwt)	156*s.* 0*d.*	+1*s.* 0*d.*	157*s.* 0*d.*
Fat sheep and lambs (per lb estimated dressed carcass weight)	3*s.* 3½*d.*	No change	3*s.* 3½*d.*
Fat pigs (per score deadweight)	51*s.* 11*d.* (subject to a reduction of 1*d.* per score in Gt. Britain) related to a feed price of 31*s.* 5*d.* per cwt.	−2*s.* 0*d.*	44*s.* 9*d.* (subject to a reduction of 1*d.* per score). This guaranteed price for pigs is related to a feed price of 26*s.* 3*d.* per cwt and is equivalent to 49*s.* 11*d.* per score related to the 1957–58 feed price.
Eggs—hen (average per dozen)	4*s.* 6·2*d.* (subject to a small reduction in Gt. Britain)	−1½*d.*	4*s.* 0·95*d.* (subject to a small reduction in Northern Ireland).
Eggs—duck (average per dozen)	2*s.* 10·2*d.* These prices were related to a feed price of 29*s.* 10*d.* per cwt.	−1*d.*	2*s.* 5·7*d.* These prices are related to a feed price of 25*s.* 9*d.* per cwt and are equivalent to 4*s.* 4·45*d.* per dozen for hen eggs and 2*s.* 9·2*d.* per dozen for duck eggs related to the 1957–58 price.
Fleece wool (average per lb)	4*s.* 8½*d.*	No change	4*s.* 8½*d.*
Milk (average per gallon)	3*s.* 2·70*d.*	−1*d.*	3*s.* 1·70*d.*

Crops

Commodity	Guaranteed Prices for 1957 Harvest as determined after the Annual Review, 1957	Price change compared with the 1957 Annual Review guarantee	Guaranteed Prices for 1958 Harvest as determined after the Annual Review, 1958
Wheat (average per cwt)	28*s.* 7*d.*	−6*d.*	28*s.* 1*d.*
Barley (per cwt)	29*s.* 0*d.*	No change	29*s.* 0*d.*
Oats (per cwt)	27*s.* 5*d.*	No change	27*s.* 5*d.*
Rye (per cwt)	22*s.* 1*d.*	No change	22*s.* 1*d.*
Potatoes—ware (average per ton)	225*s.* 0*d.* which on the basis of the new guarantee riddle is equivalent to 229*s.* 0*d.*	No change	229*s.* 0*d.* on new basis
Sugar beet (per ton, 16·5 per cent sugar content)	130*s.* 6*d.*	No change	130*s.* 6*d.*

Production Grants

The existing production grants, amounting to about £80 million a year, are being continued and the following increase is being made:

Fertilizer Subsidy. Increased rates of subsidy for nitrogen from the 1st July next, involving additional payments of some £1¼ million.

Rabbit Clearance Societies are being introduced and an allocation for this purpose has been made within the total of the guarantees.

Book Reviews

The Living Forest. H. L. EDLIN. Thames and Hudson. 25*s*.

Trees have always meant more to man than just another form of life. To primitive peoples in many widely separated places of the world, they have been objects of veneration and ritual worship, the abode of gods and goddesses and of departed spirits, the seat of oracles and the home of dryads. We may have disengaged ourselves from the stronger superstitions attaching to tree life (even if the maypole is still erected on a few village greens), but the fascination of trees remains.

Forester and botanist though he is, Mr. Edlin clearly shows himself in this book to be under their spell. His purpose has been to bring together all that he has been able to discover concerning the romantic history of the common kinds of British trees, the legends that have invested them and the use of their timber in the traditional crafts of the countryside. He has done it superbly well, producing a book which is equally a delight to read and a store of learning and lore to refer to.

Mr. Edlin deals first with our native trees, established by repopulation from the Continent as milder weather loosened the glacial grip of the Ice Age upon Britain; first, the small hardy shrubs came in across the land bridge, then the pioneering birches, rowans and Scots pine, to be followed by the broad-leaved trees such as oak, ash, wych-elm, hazel and, finally, as the climate became more congenial, the less hardy beech, hornbeam and the poplars.

When, ultimately, the sea severed the land link, the basic pattern of British woodlands had been laid down. Thereafter, additions could be made only by deliberate introductions of species from other lands: trees such as sweet chestnut, walnut and sycamore, which were probably brought in by the Romans; those like the almond and beech sought out by the Saxon monks; and later the collections made by the landowners, first to beautify their estates and subsequently to meet the more material considerations of planting for timber. This growing enrichment of British woodlands Mr. Edlin deals with in the second part of his book, showing that by the end of the sixteenth century most of Europe's outstanding native trees had been introduced here, and by the end of the eighteenth, exotic specimens from the New World and Asia.

Not the least interesting chapter in this wholly entertaining book is that describing the use of pines against the sterile sandlands—in particular, the reclamation of the Culbin Sands which lie along the coast of Moray Firth, between Nairn and Lossiemouth. For more than two hundred years the wind-eroded sand which covered the fertile Barony of Culbin over twelve square miles, and in places to a depth of 100 feet, remained a desert. Now, thanks to the Forestry Commission, who started work on this problem area in 1921, a combination of planting with Corsican and Scots pine has reclaimed the area in a most spectacular way. Other coastal strips in S. Wales, Anglesey and Lancashire, and inland areas such as Thetford Chase, Sherwood Forest and the exposed heathlands of Hampshire and Dorset, have similarly been won back from desolation by these pines. There is thus a modern as well as a medieval "magic" about trees.

S.R.O'H.

Dairy Produce, 1957. Commonwealth Economic Committee. H.M. Stationery Office. 5*s*. (5*s*. 9*d*. by post).

Statistics provide the background of factual information for policy-makers and an interesting study for those who are engaged in the manufacture or marketing of the commodities about which the statistics have been compiled. The 1957 review of world trade in dairy produce admirably serves both these purposes.

Useful though the figures for a single year might be, those over a range of years have a much greater value in that they indicate trends. This review spans the years 1952–56 and gives comparable figures for 1938, and references to tendencies in 1957. In addition to showing the volume of production and trade, it sets out in the appendices recent measures introduced in twelve countries to foster

and maintain production, trade and consumption.

Tables of figures alone call for very concentrated study in order that conclusions may be drawn from them. Here the reader is saved such labour by the interpretations of the figures in the text which accompanies the tables. Further, the introductory chapter stimulates the interest and the reader knows that he will be rewarded by perusal of the chapters which follow. It is perhaps unfortunate that in some passages the clarity of presentation of the figures is not matched by equal clarity in the text.

The statistical tables cover broadly three aspects—production, utilization and the import and export trade. Certain general conclusions emerge from them. Milk as a commodity of world-wide production has shown a tendency almost everywhere to increase in quantity, except for a slight check in 1955, and the increases have mainly been manufactured into butter. The very great importance of milk production in agriculture has led to widespread adoption of measures to support the price of milk and milk products. The description of these measures in the appendices adds much value to the review. For those whose interest in the industry extends beyond the confines of the individual dairy farm or the business of the creamery this review gives a comprehensive picture of the world's trade in dairy products.

K.H.B.

Farm Machinery. C. CULPIN. Crosby Lockwood. 35*s*.

Like a first-class machine, *Farm Machinery* must be regarded as a wise investment, rather than an expense. It can repay its cost many times over. I have read a number of books on farm machinery: this one is of a higher standard than the rest, and should be given a space on the bookshelf of everyone in farming likely to have any contact with an agricultural machine.

Whether one is a student in his first term at a farm institute, a fitter at the local agricultural works, or trying to cope with the normal farm's ever-increasing range of mechanical aids, this book cannot fail to be of help. Some may not regard it as suitable for reading from cover to cover, preferring to make occasional references to specific sections, but whatever the method of reading, the time spent will prove profitable.

First published in 1938, the book can be said to have grown up with the mechanization of British agriculture, for each edition has been brought completely up-to-date. The fact that 25,000 copies have already been sold should speak for itself. One aspect which rather appeals to me is the fact that the writer does not concentrate on a lot of mechanical theory, but deals in a sensible and interesting way with some of the actual farming problems with which the machine has to cope.

Mr. Culpin is certainly to be congratulated, and I would venture to suggest that the only people likely to wish that it had never been published are those who live by repairing farm machinery! A thorough study of this book must surely contribute in no small way to better machinery maintenance and, consequently, fewer expensive breakdowns.

G.J.

Orchids. MARCEL LECOUFLE and HENRI ROSE. Crosby Lockwood. 17*s*.

There is no doubt that horticultural books need colour illustrations. Especially is this true of such beautiful exotics as orchids, and it is therefore a pleasure to find a book with twenty orchids beautifully illustrated in full colour. There are also many monochrome plates which are clear and helpful. The text is simply written and provides a very easily understood guide to the floral characteristics of the orchids, and also to the morphological characters of the plants. The bulk of the text consists of an alphabetical list of orchids which the amateur could attempt with some hope of success, and there are chapters on cultivation and the general care of the plants.

The book has been translated from the French and, except for some of the captions on the photogravure monochrome plates which have been printed in France, the translation has been exceedingly well done. The book forms a valuable addition to the others which have appeared in the same series, and which have been illustrated in colour with a generosity that we would like to see equalled in other publications.

R.H.

Survey of Agricultural Libraries in England and Scotland, 1957. Royal Agricultural Society of England. 12*s.* 6*d.*

This survey by the R.A.S.E. is the first comprehensive list of agricultural libraries to be published and it will, therefore, be eagerly sought as a useful guide for librarians, information officers and scientific staff engaged in agricultural research. Some 46 libraries are listed, ranging from national and government libraries, like the British Museum and the Ministry of Agriculture, Fisheries and Food, to the libraries of research stations and societies like the Grassland Research Institute and the Royal Horticultural Society. The tabulated description of the facilities at each library is reasonably full and gives the scope of the library, any special collections, number of books and periodicals in stock, type of catalogue and classification scheme used, loan arrangements, the compilation of book lists and abstracts, documentary reproduction equipment, etc.

Despite its omission from the title, this list does include Wales.

R.G.C.D.

Farm Book-keeping (4th Edition). JOHN KIRKWOOD. Green (Edinburgh). 18*s.* 6*d.*

A generation of students at agricultural colleges and farm institutes have learned the basic principles of book-keeping with the aid of this excellent manual since its publication 35 years ago. It consists of two parts; the first setting out the double-entry system and the second outlining a simpler cash-book method. Many students will assert that for the average farm the double-entry system is unnecessarily complex and elaborate. The simpler method is quite sufficient to satisfy the tax inspector, and that is the main purpose for which most farmers keep books.

Over the last few years the adaptation of farm accounts for economic study, to make a more informative instrument of farm management, has received much attention. It is a pity that in preparing the present edition the author has not allowed this development to modify his approach. If records are to be kept in as much detail as is recommended here, it would have been useful to be told how the figures can help towards successful farming. But several recent publications deal with that subject, and the fact that this book has been reprinted three times and gone to four editions, suggests that it still meets a demand.

W.K.P.

Books Received

England's Forests. H. L. Edlin. Faber and Faber. 30*s.*

Grower Guide Annual (1st Edition). The Grower and Prepacker. 21*s.* (Free to subscribers).

The Story of the Wheel. Public Relations Department, Dunlop Rubber Company. Free and post free.

Proceedings of the British Society of Animal Production, 1958. Edited by I. L. Mason and G. Wiener. Oliver and Boyd. 15*s.*

Japan's Economic Recovery. G. C. Allen. Oxford University Press. 25*s.*

Estimating for Woodworkers and Country Builders. (Publication No. 61). Rural Industries Bureau. 5*s.* 6*d.*

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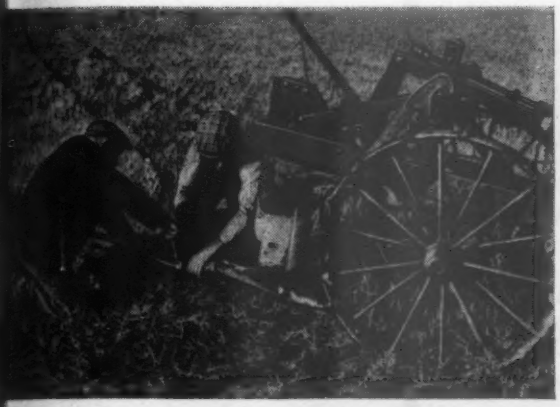
Laying 'Alkathene' tube by mole plough

on the Earl of Lonsdale's Estates



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